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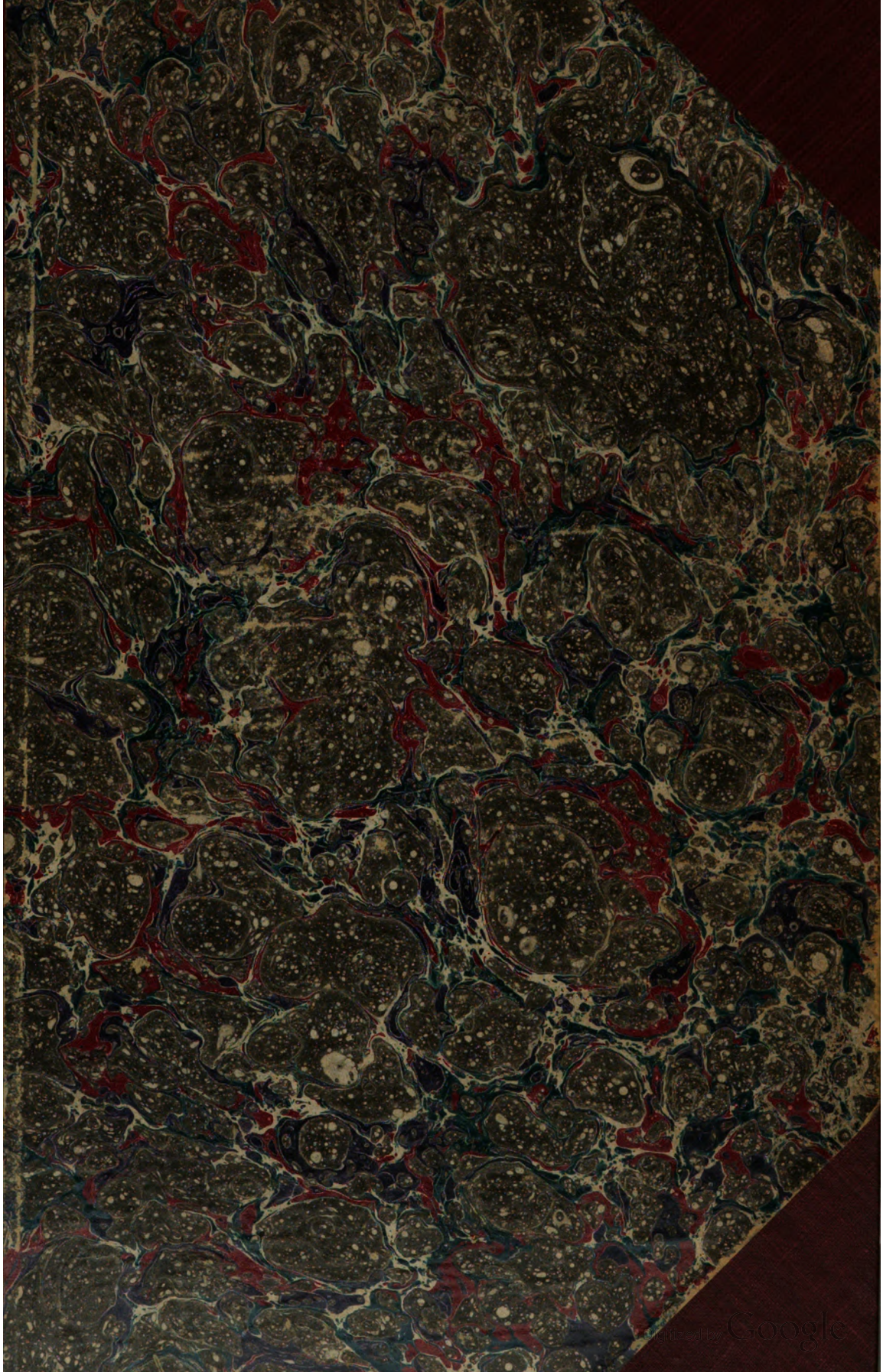
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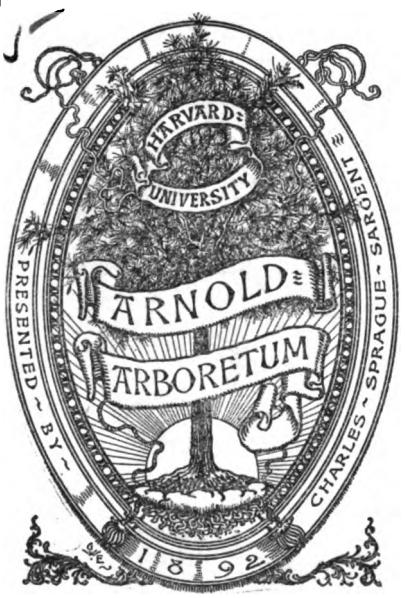

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TWENTY-FOUR VIEWS

OF THE

VEGETATION

OF THE

COASTS AND ISLANDS OF THE PACIFIC

WITH EXPLANATORY DESCRIPTIONS

TAKEN DURING THE EXPLORING VOYAGE OF THE RUSSIAN CORVETTE "SENJAWIN," UNDER THE COMMAND OF CAPT. LÜTKE, IN THE YEARS 1827, 1828, & 1829

BY F. H. VON KITTLITZ

TRANSLATED FROM THE GERMAN AND EDITED BY

BERTHOLD SEEMANN, PH.D., F.L.S.

AUTHOR OF "THE BOTANY OF THE VOYAGE OF H.M.S. HERALD," ETC.

LONDON

LONGMAN, GREEN, LONGMAN, AND ROBERTS

1861

Price Two Guineas

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1861

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COASTS AND ISLANDS OF THE PACIFIC

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LONDON
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TRANSLATOR'S PREFACE.

WHEN in 1859 Mr. Church exhibited his "Heart of the Andes," men of science began to hope that the time had arrived when their endeavours to spread a correct knowledge of the physical features of our globe would be aided from a side from which they have long anticipated assistance; that artists, encouraged by the success which Mr. Church's well-known painting achieved, and taking advantage of the great facilities of reaching the remotest portions of the world in an incredibly short space of time, would have suspended for a while the studies of the shady lanes and babbling brooks of Northern Europe, or the purple skies of beautiful Italy, in order to devote themselves to the rich field that the unknown regions of the tropics or little known countries of the temperate or frigid zones offer. These sanguine hopes have been disappointed. Our exhibitions of paintings are annually overflowing with landscapes, but they are of the old stamp.

When every branch of science, enlarging its horizon, is seized with a laudable desire to take a comprehensive grasp of the matter appertaining to its respective department; when no historian, who values his repute, now writes the history of a country without ascertaining its bearing and

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relationship to that of the whole earth; when no geologist dares to advance conclusions without knowing what his brethren have brought forth; when no zoologist can publish the fauna, no botanist the flora, of a district without examining the surrounding regions; when philologists no longer attempt explanations without having examined the whole range of human speech, — artists have, in contradistinction to this general tendency towards universality, remained essentially "local." The fact that North America may now be reached within a week, at less expense than Italy, and the antipodes in forty days, seems to be quite lost upon them, and the treasures there to be found are doomed to be hidden until laid bare by the wand of some future artistic magician.

Well may we exclaim, Are all the virgin forests destined to perish by the axe before one master hand will attempt to preserve their grandeur on canvas for the instruction of posterity? Are our descendants to possess nothing save the bare descriptions of the gigantic trees of Western America? When every vestige of them shall have disappeared, will it be believed that in our days there existed vegetable monsters, whose ages were not calculated by hundreds but by thousands of years, whose summits overtopped those of our highest cathedrals, and rivalled the pinnacles of the great pyramids? Are we to have nothing save miserable daubs of the dazzling autumnal changes of colour undergone by the flora of Canada and the United States? Is the majestic grandeur of a coral reef under the bright skies of the South Sea no theme of inspiration? Are the beauties of a coral bed, reflected through the crystal waters of the ocean, with all the manifold form, colour, vegetable and animal life, a veritable "*sea-scape*," out of the region of the *land*-scape painter?

There is every reason to suppose that art itself would be as greatly benefited as science is by their votaries extending the sphere of their studies. In order to seize upon the features peculiar to a country, one must be able to compare them with those of others. To appreciate at

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one glance the *characteristic beauties* of England or Europe, one must have seen more than England or Europe; and artists would be able to improve even upon their present style of shady lanes, &c. &c., if they had spent a few nights in the desert, made several excursions in a virgin forest, or seen the mighty working of the icy masses in the Arctic and Antarctic circles.

The physiognomy of plants is a subject which can be advanced, perhaps, more by intelligent artists than by botanists. Our morphological learning disqualifies us, in a great measure, for physiognomic studies. With our heads crammed with theoretical prototypes, and fully imbued with the desire to discover, under the unimportant external drapery, the law to which our classifying age attaches so much value, we are apt to overlook physiognomic features altogether; and our sense of the beautiful is so little cultivated, that it would be in danger of becoming totally blunted if it were not brought in daily contact with the grand works of nature. Not so the artist, who, free from this incubus, and looking upon the scenes before him without any preconceived notions, would probably lay hold of their chief physiognomical features, if he were an intelligent man, much more readily than we plant-hunters.

A striking instance of this is given by M. Von Kittlitz. Though little versed in botany, as he candidly admits, he has produced a series of pictures which are unrivalled for their truthfulness, and will ever be a source of deep interest and study, whether we regard them with the eyes of artists or of botanists. On the Continent they have been fully appreciated, and it is stated that the work, from which the plates here given have been reduced, is totally out of print. Indeed, the copy placed at my disposal by the publishers for the purpose of translation, is said to have been the last that could be procured.

It must ever be a matter of regret that the talented author, who first prepared the originals and then spent years in order to perfect himself

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in etching before he attempted their reproduction, could not have had the co-operation of the botanist of the expedition, and was reluctantly compelled to prepare the letterpress himself. I have endeavoured to mend the defects of the latter as much as lay in my power, by adding foot-notes where it was most necessary; whilst my personal familiarity with most parts of the globe enabled me to free the text from much of the ambiguity, caused by a laudable desire on the part of the author not to commit himself to statements for the entire accuracy of which he did not deem it prudent to pledge himself.

BERTHOLD SEEMANN.

London: July 20th, 1861.

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VEGETATION

OF THE

COASTS AND ISLANDS OF THE PACIFIC.

INTRODUCTION.

Since Alexander von Humboldt ranged the geography of plants amongst the sciences, much has been said and written on this eminently popular and attractive subject; nevertheless we must look to the future for the most interesting results of the inquiries instituted. The materials of scientific value relating to the physiognomy of vegetation, that charming and grateful study, are for the most part confined to a few more or less comprehensive descriptions, and comparatively a limited number of happy pictorial illustrations. Yet illustrations of that nature are an essential element of a branch of science the object of which is principally an immediate appeal to the eye. We still require a considerable number of faithful illustrations before we shall be able to collect into one or a few folios a complete series exhibiting the most prominent peculiarities of the beautiful garb in which Nature has clothed our planet, like the bird in its plumage; whilst the contemplation that wherever man penetrates he appears destined to destroy or modify by cultivation this natural ornament, only tends to increase the wish for early and frequent contributions towards such a collection. The following plates are intended as such; and before proceeding to describe them more fully I shall point out the astonishing richness which Nature displays in the characteristic groupings called the physiognomy of a country.

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In order to obtain a correct conception of these riches, it is necessary to call to mind the spherical shape of our globe. The different climates and their transitions will then be most evident. It is well known that their differences exercise a direct bearing on those of the vegetation; heat and moisture, the various degrees of which determine climatic differences, also constituting the principal conditions of vegetable life. The greater the harmony in which these two agents act, the grander the result of their co-operation. This is the reason why the lowest latitudes, the tropical zones, with exception of their arid deserts, exhibit the greatest force of vegetation, the finest and most diversified forms, and the largest number of species. At every marked approach towards the icy poles, and in proportion as the temperature decreases, the vegetation becomes altered, assuming more and more what has been termed a "northern look," until it dwindles down to an Alpine flora, and ultimately to a mere crust of lichens covering the rocks. What a variety of features must there be ranged between this extreme and the gigantic forests of the equinoctial regions!

As the temperature decreases with the increasing altitude, exactly the same succession is exhibited in the different regions of the higher mountains, where the various forms of vegetation, from those of the temperate zones to the polar, the limits of perpetual snow, are found successively. But, however much diversity there might be in these gigantic terraces, if in every instance the same characters were repeated, interest in them would be much diminished. One would in that case only have to ascend a given mountain, the summit of which reached the region of perpetual snow, in order to behold the vegetation of the cooler regions. A country situated in about latitude 30° south would present as faithful a picture as one situated as far north. This, however, would ill agree with the evident tendency of Nature towards diversity, its manifold variations of certain forms, and the transition to which they give play. Nature has guarded against the forests of the Straits of Maghellan having quite the same aspect as those of Europe. Certain plants of both hemispheres may be similar, but there are specific differences which separate them and render their mutual similarity very slight.* The very different distribution of land and sea hardly produces in corresponding latitudes a sufficient similarity of climate to insure, even in part, a complete identity of species. Experience has also demonstrated how difficult it sometimes is, in attempts at trans-

* This is not absolutely the case. There is a number of species which are found wild in *both* the Arctic and the Subantarctic circle. A list of them was given in my Flora of Western Eskimo-land ("Botany of the Voyage of H.M.S. Herald," London, 1852–1857, p. 20), and that will no doubt be considerably extended by future researches.— *Berthold Seemann.*

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plantation from one hemisphere to the other, especially from the southern to the northern, to discover the suitable climate. It is true, in the warmer zones of one and the same hemisphere, the different regions of the mountains, having greater climatic relationship, exhibit many species belonging to the colder zones; but there are generally a few forms peculiar to warmer countries, which extend their range high up these mountains, imparting to them their idiosyncrasy. This mixture of plants appertaining to different climates imparts quite a peculiar physiognomy. A district in the Mexican mountains 8000 or 9000 feet above the sea, does certainly remind us by its oaks and firs of North America, or even Europe; but only to render its *Yuccas* and *Fourcroyas* still more prominent features.

But it is not only latitude by which we measure differences in the typical forms of vegetation, principally caused by the climate; the longitude also works decided changes in the vegetation, which, though subordinate to the former, and apparently quite independent of climate, nevertheless present everywhere new pictures.* Passing over the striking and numerous physiognomic differences caused in one and the same zone by local circumstances, such as deserts, steppes, and great swamps, we mention only those observable in regular and gradual transitions in the same latitude, but different longitude, and under almost identical climatic conditions. The phenomenon first presenting itself is that the geographical range of most species is not of sufficient extent to occupy longitudinally the whole zone, of course most frequent where the zones are longest, *i. e.* in the lowest latitudes, and least frequent where shortest. This is the reason why, in the neighbourhood of the poles, the geographical range of species extends, without regard to continents, over the whole zone, which is short enough to be filled up by it; but on nearing the equator, those species, the home of which is the entire zone, continually decrease in proportion to the other occupants of the soil, and thus an increasing number of districts of distribution is ranged side by side, in order to provide for the continually increasing length of the zones.

Thus, in consequence of the spherical shape and position of our earth, continually increase, with the temperature of the climate, not only the capabilities of vegetation and the number of species of each country, but also the space, so that the principal character of the vegetation as imparted by the different climates may obtain full play to divide in numerous variations longitudinally defined. The

* It is true that the zones, of which the geography of plants takes notice, are defined by the wavy isothermal lines, &c.; but these lines have on the whole the same direction as those straight ones of which mathematical geography avails itself.

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so-called region of palms, the longitudinal range of which is the most extensive, would seem to be on that account the richest in species as well as in peculiar features. How interesting would prove the contrast between three views representing respectively an East Indian, an African, and an American virgin forest, as nearly as possible having the same soil and climate! Without doubt there would be in all three much physiognomic resemblance, notwithstanding the total difference of their component elements. What in the one would only be indicated, would in the other have obtained full development. Thus climbing plants play a more important part in the physiognomy of the Indian jungle than in that of the American forest, whilst the latter enjoys the advantage of harbouring a greater number of strange and beautiful epiphytes. Here then the difference between the continents, totally disappearing towards the poles, is most evident.

It is unnecessary to mention that these differences stand in the same relation towards those of the geographical latitudes, as the species do towards the genera, and that, as a rule, only allied species or forms represent each other in the different longitudinal divisions of one and the same zone.* The facility with which almost all species may be transplanted from one of the longitudinal divisions into the other, though a well-known fact, should be noticed as tending to prove more than all others that the longitudinal differences are essentially independent of climate, and not caused by certain subdivisions of it. The law according to which one part of a zone originally produces this, the other that form, does by no means preclude interchange of species, and it would almost seem as if Nature had originally adopted that mode of distribution in order to show even here its tendency towards diversity. The transition being, generally speaking, only gradual, it would be difficult to find in all cases for the various physiognomy of plants a well-defined boundary line. Still Nature has bestowed on every part of our earth's surface which we geographically may term "country" peculiar beauties, by which it may be known as readily as one organic being from another. Without this higher significance the chequered masses, which would otherwise appear less noteworthy, become important objects of science and the art subservient to it. True, the latter has no slight problem to solve. Not only is travelling in far-

* Of course in allied species there is a certain resemblance in form, but very often the type prescribed as it were to a certain climate, selects, in the different longitudinal divisions, plants belonging to widely different families. To cite one instance: the mountain plant from Simen, figured and described by Rüppel in his "Abyssinian Journey," though related to the *Lobelias*, strikingly recalls the *Yuccas* of the higher mountains of America situated in the same latitude. In the extreme east of the Old Continent this form is represented by screw-pines (*Pandanus*), having a single crown supported on an erect trunk.

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distant and barbarous countries still associated with difficulties, but in order to draw these pictures very different circumstances have to be considered from those which affect ordinary landscapes. The artist must see with the eyes of a naturalist. He must also be in the position to have at least the engraver under his continued control, if the real value of his work is to be preserved. Besides, there are required numerous contributions from all sides in order finally to form that great collection, the object of which will be always more scientific than artistic; and it does not appear advisable to refrain from publishing what has been prepared exclusively with this end, merely because, viewed from a purely artistic point, it may be deemed unsatisfactory.

This applies to the following "views," in which doubtless much of the accustomed artistic effects will be missed; nevertheless they will, it is hoped, supply a fair notion of the countries in which they were taken. It may also not be deemed superfluous to add a few words about the way in which they originated. On the departure of the Russian corvette "Senjawin," in 1826, the botanists of St. Petersburg suggested that, as opportunity offered, as many portraits and characteristic sketches of the vegetation as possible should be taken. Although unacquainted with botany, I was deeply interested in carrying out this suggestion, and in my mind conceived a series of pictures, from which the following may have borrowed its form. Still want of time, generally experienced by the naturalists of exploring expeditions, would probably have prevented me from carrying my resolution into effect, if the nature of my occupation had not essentially tended to favour it. Sporting and collecting zoological objects constantly brought the features of the vegetation before my eyes. Setting out with the determination to construct a view, I generally succeeded in accomplishing it during the short time that we used to remain at anchor in each place, provided I had collected the necessary materials. These consisted — 1, in a sketch of any comprehensive landscape, in which generally several, according to the principal peculiarities of the soil, were joined; 2, in a sufficient number of portraits of the larger plants, occupying the respective soils, and which, unless already embodied in the general sketch, might unhesitatingly be introduced. A rough draft of the whole was generally made directly after leaving the country to which it referred, when the survey of nothing save sky and water did not interfere with the vivid recollections of impressions just received. A few possible mistakes were guarded against by the presence of Dr. Mertens, my dear friend and travelling companion, who generally knew well the plants illustrated, had collected them himself, and preserved what he had seen fresh in his memory. Thus these "views," even when origi-

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nating, were under the control of a wholesome criticism. It was long the favourite idea of my friend to write to them explanatory letterpress; and if his unexpected death had not prevented the carrying out of his plan, the whole would have been an interesting work, whereas now the plates may rather suffer from want of fuller explanations than here given.

I may also be blamed for undertaking the execution of the plates on copper myself, instead of assigning them to more artistic hands, which would have insured more elegance and saved me the time necessarily lost in trying to perfect myself for a self-imposed task. But the points on which in this case everything depends, the true character of the views represented—the portraiture, so to speak—would have lost by that process more than it would have gained by the supposed increase of elegance in execution. It is perhaps not generally known how extremely difficult it is to obtain from the hands of an engraver or lithographer a correct copy of a picture embracing such numerous and delicate points of character; but proofs are furnished by a series of expensive illustrations in works of travel, which convey no idea of the scenes represented, though it was not from want of good original drawings. This applies with full force to what alone is here to be represented, characteristic foliage and large masses of vegetation generally. One may justly say that an artist must have seen them in nature merely to copy a drawing without utterly spoiling it, to say nothing about rendering it in quite a different manner. The most talented landscape painter can only reproduce the "*je ne sais quoi*" in the character of those districts which he has seen himself, and he would violate Nature if suddenly called upon to paint objects belonging to climes foreign to him. It is true the shadows of a tropical forest, for instance, are subject to the same laws as elsewhere, but still they are formed in a peculiar way, difficult for a painter to convey. As for descriptions it is impossible for them to supply the place of illustrations. The expressions so often used by travellers in dwelling on tropical vegetation, — "Innumerable branches and leaves form such a thick mass that the rays of the sun cannot possibly penetrate," &c.,—are calculated to give, and in many instances do give, a very erroneous impression. Judging from such descriptions, I had imagined a deep shade, a darkness almost approaching to night, and much greater than that of our pine forests; and I was not a little surprised to perceive so much light under the finest trees, the widely spread foliage of which nowhere allowed the sky to be seen. At first I was inclined to ascribe this solely to the perpendicular light of noon, but, after observing the same phenomenon at every time of day, I became convinced that it was one of the characteristics of the climate. Indeed, what would become of all the plants destined to live in this

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shade, if the enormous masses of foliage causing it had not been placed and arranged by provident Nature in such a manner as to permit the solar rays, though broken in a thousand ways, to penetrate with sufficient force to the lower vegetation? Our pine woods do not require a similar provision; their darkest shade * falling on a soil which, having nothing to produce save the trees, can dispense with the influence of light, though the trees themselves do require protection against violent winds and heavy masses of snow, the melting of which is so much assisted by being distributed over the broad branches.

These very different modes of life must necessarily produce very different aspects. In a climate where the plants never suffer from the cold, they display a certain freedom looked for in vain in regions subject to great changes of temperature, and where trees and shrubs, developing a vast number of small branches, form perhaps thicker but on the whole poorer crowns. This is seen in most Alpine plants in a much higher degree, especially those growing gregariously, the leaves of which are not only placed close together, but also pressed close to the ground: the cold, it would appear, totally restricting the upward extension of the branches. This is most marked on tropical mountains, where one has only to descend into the plains in order to behold the very opposite character of the vegetation already mentioned. The peculiarity of a vegetation always enjoying a warm and moist atmosphere is particularly evident in the elegant forms of palms and tree-ferns, constituting, in reality, the type peculiar to most tropical zones. In that climate we behold not only in the *Yuccas*, *Dracœnas*, screw-pines (*Pandanus*), large *Scitamineous* plants, &c., a surprising repetition of the chief features of the palms, but to a certain extent even the external branches and spreading leaves of the largest forest trees form crowns not unlike those of palms on a small scale. If the crowns often consist of heavy and undivided leaves, and thus again differ from palms, the *Mimosa*-form, playing so important a part in the tropics, steps in, and by its delicate feathery foliage imitates the features of a palm in a surprising degree. There are even mimosa-like trees which assume a much more palm-like look than one would be prepared to expect in a dicotyledonous plant. Everywhere in that climate one observes a certain quite peculiar kind of "trellis-work," † if it may be so called, the most highly developed in the palms, and even in plants which can be but little compared to them, and probably owe their prevailing character to the free development they enjoy. Great masses of delicate

* "Juniperi gravis umbra, nocent et frugibus umbræ." VIRG. *Ecl. X.*

† This term does not quite express the author's meaning; but it is the nearest English equivalent I could find for the German "*Durchbrochenheit*."—*Berthold Seemann.*

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foliage thus look as if floating in the air. Everything, even to the smallest fern covering the ground, shows a tendency to spread and extend, preventing the different parts from resting upon each other, and forming, by lines meeting at every point, open spaces which admit light and air. On a smaller scale we find this character wherever plants grow, but more especially where, throughout the year, a uniform degree of moisture and temperature prevails. There, more than elsewhere, Nature exhibits that matchless beauty reflected in the noblest architectural monuments of the middle ages, in that airy treatment of gigantic masses and richness of forms, — the Gothic pointed arch,—the Arabic origin of which is more than probable, being formed by two perpendicular palms, and the meeting of their leaves. In hotter and drier countries all this is less evident. There, trees and shrubs have, almost as in the colder climates, a rather bushy growth, developing numerous small branches; probably owing to the regular and continuous droughts, and the summer sleep of all nature connected with them, which periodically interrupts the activity of vegetable life, as the winter does in the higher latitudes. But it would seem as if even in high latitudes, under circumstances rendering that interruption less marked, the above-mentioned trellis-like character reappears to a certain extent. Thus on the west coast of America, latitude 48° north, where there is a moist climate little subject to variations of temperature, the pine forests strictly differ from the European by a development of the branches, and a general luxuriance often recalling to mind the growth in the tropics. Perhaps the same may apply to the forests of the more southern portions of America and to New Zealand.

What has been stated will render it evident how little hope there would have been to see in the following illustrations the peculiarities of such various climates preserved, if they had fallen into the hands of artists ignorant of the points on which particular stress is laid. Although far from believing that I always succeeded in conveying the right expression, I am confident that I could not have missed it so far as those would have done inevitably; and as so much depends upon the character of Nature being correctly given, we can well afford to sacrifice to a certain extent the artistic treatment. Another fault which, with some justice, may be found with these illustrations is, that they represent objects too simple. The characteristic grouping might have been essentially the same, and would have gained as a typical picture, if more pictorial details had been introduced. To this I must reply, that this poverty has been felt acutely by myself, and that only want of time can be pleaded as an excuse, drawing not being my primary occupation during the voyage. I will not fail to direct attention to figures

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introduced from necessity, and in places more appropriately occupied by other species. If it had not been from want of time, more imposing views of the Caroline and Marianne Islands would have been produced. But here must be repeated an observation formerly accepted as correct, but again disputed, that the vegetation of such widely separated and small islands, always is far inferior, especially as regards variety, to that of larger countries of the same zone. Seemingly, the reason of this fact is not to be sought in a certain sterility of these islands, but rather in the long distance that separates them from other countries, as well as in their small size. The island of Ualan, for instance, of which several views are given, combines all the known conditions of a grand vegetation, — a proximity to the equator, constant atmospheric moisture, and plenty of water to irrigate the rich, originally volcanic soil; in consequence of this it is to the very summit of its mountain peaks densely covered with luxuriant forests. Yet, notwithstanding all this luxuriance, and the beauty of forms peculiar to that part of the world, the whole could by no means be compared in richness with the forests seen in the neighbourhood of Rio de Janeiro, or in the island of Luzon, although they are farther removed from the line, and do not possess those sources of fertility in such a high degree. Here also the character of continents predominates. On coasting along Banka and Sumatra, we had afterwards an opportunity of seeing through telescopes the character of the vegetation; and here, where all those conditions are found in an extensive country, the grandeur, beauty, and richness of form seemed to surpass all we had previously witnessed. If, therefore, the Carolines and Mariannes are not quite calculated to exhibit tropical vegetation in its highest beauty, it is the more to be regretted that want of time prevented my taking more views than are given of the splendid forests of Luzon. It was easy to show in three or four sheets the principal physiognomic peculiarities of the smaller islands; but here I was compelled to leave the real treasures as it were untouched.

The gravest fault of the present publication will doubtless be the poverty of the accompanying botanical remarks. Fully confiding in the zeal and science of my friend Mertens, I never thought of devoting the little spare time at my disposal to observations already better made by him. His loss was to us an unexpected misfortune, very nearly deterring me from laying these "Views" before the public. But, forming a complete whole by themselves, they may venture to appear even with the scanty and superficial explanation that can be offered, leaving it to future naturalists to fill up with a few words unavoidable blanks.

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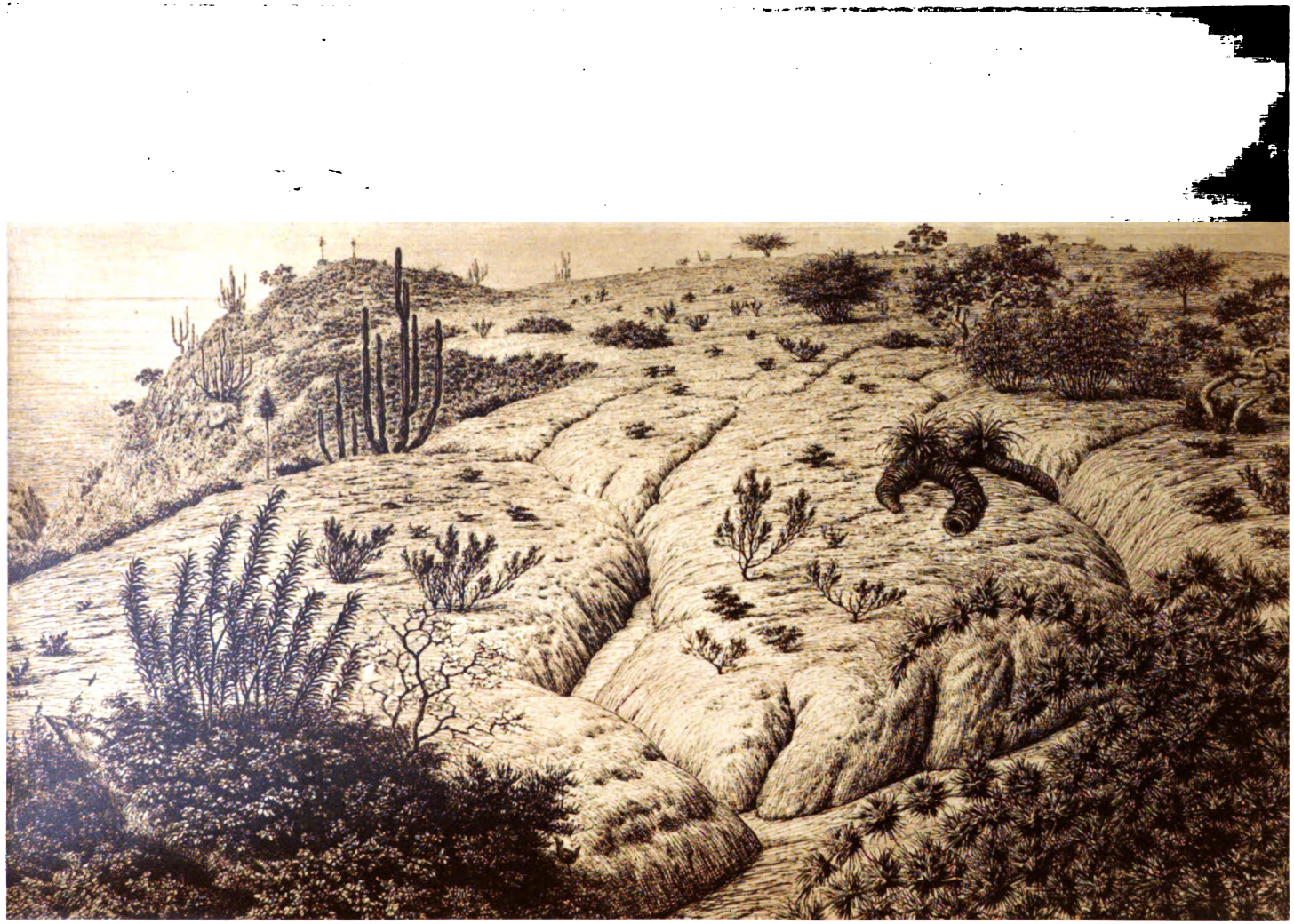

PLATE I.

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EXPLANATION OF THE PLATES.

PLATE I.

COAST OF CHILE.

VEGETATION OF THE HEIGHTS ABOUT VALPARAISO.

March.

This season of the year is here the driest, the country throughout having a burnt appearance. In August and September, the present landscape would doubtless have been a rich meadow adorned with the beautiful flowers of numerous *Liliaceæ;* at present there is everywhere the bare reddish soil; the few plants here and there visible are for the most part dried up, and the thorny bushes covering the rocky slopes without leaves. The aspect is that of a steppe during a dry season. Equally monotonous, and often much more bare, appear about this time all those little *plateaus* commencing immediately behind Valparaiso; only valleys exhibit a crowded vegetation, including trees, though they be of no considerable height. The generally stunted growth of the woody vegetation in exposed places is ascribed to the influence of regular and violent winds to which these coast districts are subject. The most prominent amongst the shrubs elsewhere attain the size of trees; they are the Caven [or Espino] (*Acacia Cavenia*, Hook. et Arn.) and the Lithi (*Laurus caustica*, Mol.). Both of them contribute considerably towards the physiognomy of the country. The Lithi may be known by its dark thick foliage and its fantastically twisted branches $\left(12\ \text{l}—15\ \frac{\text{l}}{\text{m}}\right)$; the Caven, by its broom-shaped growth, as well as by its numerous radiating branches, bearing long spines and very delicate leaves (10 l.) In this district the Lithi is very plentiful, and produces in places protected from the winds, where it can freely

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develope itself, generally several crooked, very seldom erect and straight stems. It is commonly used as fuel. The Caven is said to attain, further inland, a considerable height.* Another shrub characteristic of the district is a species of *Cassia*, which about this time bears fine dark yellow blossoms $\left(13\ \frac{l}{m}\right)$. But the chief feature in the physiognomy is the large candelabra-like *Cereus Peruvianus*, growing isolated on the edge of the slopes, and everywhere in the neighbourhood of rocks (5 d), and also the curious *Pourretia coarctata*, a plant about which Molina has much to tell, and which is probably abundant throughout Chile $\left(12\ \frac{m}{n}\right)$. The thick woody scape, with its large spikes formed by rectangularly disposed branchlets, about this time bearing roundish woody fruits, is best seen on the edge of the slope (4 d). The smaller isolated growing plants are different kinds of *Compositæ* (9 f — 10 f, &c.), plainly showing the gradual transition to shrubbiness; they have done flowering, and are scattering their feathery *pappus* in every direction: when in full bloom, their numerous flowers must present a fine sight. As an instance of the various truly shrubby *Compositæ* peculiar to this district, must be regarded those creeping bushes which seem to be mere balls of thick foliage. Their branches and leaves are very resinous, and one has only to set a match to them in order to kindle a vivid and well-fed fire. The most curious amongst the plants in the foreground is the indigenous bamboo, which certainly does not bear a strong resemblance to the Indian *Bambusa arundinacea*, and probably belongs to a genus but recently instituted (14 o). Always growing gregariously, and having high, arched trunks, it often forms, on

* In the narrative of the "Voyage of H.M.S. Herald," vol. i. p. 39, I have given the following sketch of the neighbourhood of Valparaiso, as it appeared in 1845, about eighteen years after our author's visit: — "The hills near the sea are partially clad with scanty brushwood and still scantier herbage; after passing them, the eye perceives an extensive open country. The Espino (*Acacia Cavenia*, Hook. et Arn.) abounds on these plains, and would, if attended with care, be of vast service in reclaiming the waste, by attracting moisture and affording a supply of fuel. It has been of the greatest use to miners, and also for household purposes. Notwithstanding its being cut in the most injudicious manner, it still grows again; but of late this unwise system has been pursued to such an extent, that it has in many places destroyed the growth altogether. The utility and importance of such a wood as the Espino, in a country where much fuel is required, where there is hardly any other moisture than that produced by artificial irrigation, and where land carriage must continue for many years both expensive and laborious, the wide-spread distress that must accrue from the injudicious neglect of the bounties of Nature, will be apparent to the most casual observer. There is no doubt that the aridity of the plain has been perpetuated and increased by neglecting common precautions with regard to this shrub. The Espino is brought into Valparaiso in a highly charred condition; it is very hard, gives much heat, and its ashes are sufficiently alkaline for the manufacture of soap. The stoves and warming-pans over which the Chilenian ladies are very fond of putting their feet during the cold weather, are supplied by the small bundles of charred Espino so often seen for sale in Valparaiso."—*Berthold Seemann.*

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gently sloping hills, extensive thickets, which, interlaced with fine *Mutisias*, constitute as peculiar a feature of the district as any of the previously mentioned plants. Amongst the brushwood to the left, sheltered to some extent from violent winds, may be recognised traces of the vegetation of the valleys, three plants characteristic of the country:—1. *Fuchsia lycioides*, now a leafless shrub, but covered with a number of flowers of a carmine colour $\left(5 \mid 6\,\frac{f}{g}\right)$; 2. the shrubby *Lobelia Tupa*, the dark red terminal blossoms of which could scarcely be indicated in our plate $\left(3 \mid 4\,\frac{f}{g}\right)$; and 3. a beautiful *Loranthus*, a thick bushy shrub, densely covered with leaves and growing parasitically in most trees, here in an old Lithi: it is highly ornamental, especially in the dry season, on account of its dark fresh green foliage and splendid red bunches of flowers, much visited by humming-birds (3 g).

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PLATE II.

ISLAND OF SITKA, WEST COAST OF NORTH AMERICA.

UNDERWOOD AND SWAMP.

July.

THE aspect of this country and its luxuriant vegetation hardly remind us of its high northern situation. On the eastern side of the same continent, there are no longer any trees in latitude 57°—58° north. Repeated reference has already been made, in the illustrations to the Atlas, &c., to the peculiar character of the western coast, influenced in this northern region by the high mountains, which, forming a protection towards the north, increase the mildness of the climate. Hence the uniformity of the temperature, — the necessary consequence of the perpetual influence of the sea-breezes. If the winter be generally mild, but stormy, the summer has nothing of the heat distinguishing it elsewhere, whilst there is little continued fine weather in any season. The sky is generally covered with clouds, and rainy days preponderate throughout the year. It seems to be principally this feature of the climate which imparts to the pine forests of this country their surprising power and luxuriance, and clothes even naked rocks, exhibiting no traces of vegetable mould, with woody vegetation. A succeeding illustration (Plate III.) will give a conception of these woods; the present leads us into a district, far away from human habitations, where partly the axe, partly violent winds have effected a clearing, showing amongst the remnants of old trunks the luxuriantly growing underwood; further on is seen one of those swamps, filling nearly all the little valleys, and backed by high and almost impenetrable forests. The two pines, growing intermingled in this wood, are represented in our view in several characteristic specimens, especially *Pinus Canadensis*, distinguished by its delicate foliage $\left(7 \mid 8 \frac{b}{c}\right)$. The other species, a new one, has been named

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PLATE II.

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Pinus Mertensiana by Professor Bongard $\left(2 \mid 3 \frac{c}{d}\right)$.* In Sitka it is as abundant as the former, and in growth and habit approaches our European pines; hence the Russians generally term it "Jöll" or "Jollnik" (pine), whilst the other is known by the name of "Liswen" (larch). They rival each other in height, but the stem of the Canadian pine is generally thicker, round and straight, whilst the Mertens' pine has a more diversified growth and highly fantastic branches; its stems are always slender, in proportion to the branches, and show irregular longitudinal furrows, somewhat imparting to them the look of fluted columns. Generally both species are densely covered with mosses and common lichens (*Usnea*), the latter of which, being of considerable length, remind one of the *Tillandsias* of tropical America. They are of a lively fresh green, that of the Canadian pine more inclining to yellow, that of the Mertens' pine more to blue, which renders these pine forests more beautiful than ours, the dark gloominess of which justifies the Germans calling their deciduous forests "living woods" in contradistinction to them. There will be no difficulty in recognising both species in the various young specimens given in our plate. A fine group of two young plants, which have taken root upon the undisturbed remnant of an old stump $\left(6 \mid 7 \frac{c}{d}\right)$, has been carefully copied, and furnishes a good illustration of the prevailing character of growth in this region,— old dead wood, already converted into vegetable mould, harbouring the roots of other trees, whilst it yet retains its perfect shape and bark. Thus most of the plants grow epiphytically upon their own kind, a phenomenon finding a ready explanation in the prevailing moisture and low temperature of the climate, the absence of destructive insects, &c., but which may be regarded as an interesting addition to the fact that America generally produces numerous parasites and epiphytes, of very diversified form. The third species of pine, growing isolated in swampy declivities, is *Pinus palustris*, a tree not attaining any height, and having much the habit of our *Pinus sylvestris*, but the aspect of the branches and fruit of the so-called "Knie-holz" (*Pinus Pumilio*) so common in the Alps $\left(15 \mid 16 \frac{m}{n}\right)$.† Amongst the different reciduous plants mostly assuming the form of shrubs, and here and there associated with these pines, we meet the indigenous apple-tree (*Pyrus diversifolia*, Bongard), the habit of which resembles that of the different kinds of *Cratægus*, while its fine white flowers bear a great likeness to those of our apple-tree $\left(12 \frac{n}{o}\right)$. There is

* Placed amongst the doubtful species of the section *Abies*, by Endlicher. — *B. Seemann.*

† This is probably not *Pinus palustris*, which does not grow so far north.—*Berthold Seemann.*

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also the balsamic alder $\left(\textit{Alnus rubra?}\ 10\ \frac{m}{n}\right)$ standing close to an elder-tree $\left(\textit{Sambucus},\ 10\ \frac{n}{o}\right)$, with oval terminal bunches of flowers. However, the principal mass of the underwood, especially on clearings, consists of a species of *Rubus* (probably *Rubus spectabilis*) (13 n), bearing flowers of a carmine colour and highly aromatic fruits, which, being plentiful, are important articles of food in this country. Another *Rubus*, without edible fruit (*Rubus Nutcanus*) (12 p) is distinguished by its large white blossoms, and delights to grow in the outskirts of thickets, in less humid places, where it finds a neighbour in one of the two species of *Ribes* abounding here $\left(9 \mid 10\ \frac{p}{q}\right)$. But the most striking of all the underwood, more especially in the upper forest region rather than in this locality, is *Panax horridum*. Well-known descriptions afford an erroneous idea of its habit; thus in Meyen's "Geography of Plants" (1836), it is termed "a remarkable creeper." In the present illustration it is shown first as a low, densely-leaved shrub, as it appears on the outskirts of forests and in sunny places $\left(7\ \frac{f}{g}\right)$, and again with more developed stems, which up to a certain height are leafless, and terminate with a tuft of very large palmate leaves, a growth it assumes in shady and rather humid places $\left(2 \mid 3\ \frac{f}{g}\right)$. The stems often attain double the height here shown; they are everywhere covered with rather long, strong, and dark brown spines, which do not stand off at right angles, but are pressed to the stem with their points directed upwards. The peduncles and petioles are also clad with spines, but they are less prominent. The leaves have a rough surface, are thin and rather transparent, and of a pale yellowish, rather dirty green colour. At the top of the stems appears a longish erect head, consisting of a mass of minute pale-yellow flowers. The fruit is a small fleshy, very resinous berry, which, as far as we could learn, is neither eaten nor otherwise turned to account. Until the end of July,—we did not see it later,—it is in an unripe state and then pale green, but it is said to become red, and during the last day of our stay (July 31), several were turning that colour. A tall, fine-looking plant, here and there observed on the outskirts of woods, I am unable to determine botanically, nor could Professor Bongard afford any clue when the herbarium specimens were submitted to him. I have, however, closely copied the original drawing made in Dr. Mertens' presence (14 o). The little shrubs, chiefly growing upon old trunks of trees, are principally species of *Vaccinium*, amongst which at least two may be distinguished, one having roundish, rather blue green leaves (6 e), and the other possessing a more myrtle-like habit

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(7 e). They often attain a greater height than the specimens here shown. Larger and smaller groups of different kinds of grasses are generally associated with them, imparting quite a picturesque appearance to the tops of old trunks of trees. Amongst the smaller plants of the foreground, the beautiful *Dracontium Kamtschaticum* ought to be noticed $\left(4 \mid 5 \frac{g}{h}\right)$. It is rather common in the lower forest districts, and grows in the manner here represented in the different valleys between old remnants of fallen trees, localities in the neighbourhood of which there is generally more humidity. Such spots produce a great variety, often tall ferns (4 f), fine *Carices* (5 g), and numbers of *Cornus Canadensis*, in full bloom about this time (9 p). Mosses and lichens are, as might be expected, so plentiful, that they exercise a considerable influence on the colouring of a picture. There is no lack of herbaceous plants with fine flowers about this season, but few of them are large enough to be recognised in my illustration. Three of them are, however, so characteristic, that they must be indicated at least in the extreme foreground, — the fine scarlet *Aquilegia Canadensis*, the *Mimulus guttatus* here reaching up to your middle, and the dark Sarannah lily (*Lilium Kamtschaticum* = *Fritillaria Sarannah*), renowned for its fine-flavoured bulbs, forming an important article of food in the Aleutian islands and in Kamtschatka.

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PLATE III.

SITKA.

WOODY MOUNTAINS.

July.

A WELL-KNOWN phenomenon is the sudden transition from the mild climate of some coast districts to the more severe one, peculiar to the country on account of its latitude, as soon as the observer leaves the region influenced by tempering sea-breezes. Little as is known about the countries situated on the other side of the protecting chain of mountains, east and north-east of Sitka, there can be no doubt that their climate must be much more severe. This difference becomes evident even where the immediate influence of the sea-breezes just terminates, as is plainly shown in the character of the vegetation of such localities as that here represented. The narrow bays, stretching far inland, so common on this coast, offer a good opportunity to observe this even from the sea, and still better from the equally numerous long and narrow inland lakes, which are completely separated from the ocean by a ridge of mountains. Plants which at the seaside belong to the upper mountain region, are here growing at the sea level; the growth of woody species is comparatively scanty, and instead of the luxuriant underwood there formed by different kinds of *Rubus*, &c., we have here a rocky soil covered with mosses. The present illustration refers to such a district, termed "Glubokoje Osero," or "Deep Lake." Its elevation above the level of the ocean probably does not amount to more than fifty feet, but its situation deprives it of the influence of the sea-breezes. The great number of dead, and yet standing trees, impart to the forest, as to all those of the mountains of this country, a curiously mixed appearance. It is hardly necessary to add that those trees are principally covered with a dense mass of lichens in general, and *Usneas* in particular. Here *Pinus Canadensis* and *Pinus Mertensiana* grow together, often mingled with the beautiful *Thuja excelsa*, Bong. (*Chamœcyparis Nutkaensis*, Spach)(4 g; 5 | 6 d; 5 | 6 g), which near the sea is only in the higher

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PLATE III.

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mountain regions as abundant as it is here. Its tall, slender growth, its wide-spread branches with their picturesquely grouped and drooping branchlets, distinguish it amongst the surrounding trees, and render it the most typical of these forests. It is of a darker and bluer green than the two prevailing species of pines. Its straight and strictly cylindrical stem rivals in height as well as in circumference that of the oldest Canadian pines; it has a pale grey, delicate bark, with regular longitudinal rents, carefully collected by the natives and used in a variety of ways. We also observe here a fir, not essentially differing from the above-mentioned *Pinus palustris*, but attaining a considerable height $\left(3\ \frac{c}{d}\right)$. The fifth conifer of this district, named *Pinus Sitchensis* by Bongard, grows isolated or in groups only in the higher meadows. Such a locality could be introduced in the present "view" solely by availing myself of a poetical licence. The chief feature of this mountain pine principally consists in its numerous little branches, clad with a delicate pale green foliage, not drooping as in most of its congeners, but standing upright, and forming fine horizontal bowers (14, m). In a less marked manner the same trait of character may here and there be seen in the Canadian pine, especially growing in those colder situations in which the present view exhibits it. A specimen projecting little above the water may be regarded as an instance of this variation of its growth $\left(7 \mid 8\ \frac{c}{d}\right)$. Of woody plants with deciduous foliage, we notice here only the so-called white alder, forming colossal shrubs close to the water $\left(6\ \frac{e}{f}\right)$. Several species of *Vaccineæ* attain in such places no less conspicuous dimensions. But in the narrow valleys are growing here and there tall ferns, alternating with *Panax horridum* and a rather large *Heracleum* (*H. lanatum?*). Generally speaking, this west coast appears to be less poor in umbelliferous plants than the other parts of this continent. The numerous *Vaccineæ* of this district are augmented by a peculiar plant, growing in the colder parts of the forest, and having a very different habit and form of leaf, but flowers closely resembling those of the large kinds of *Pyrola*. Indeed, it is a shrubby *Pyrola*, as Dr. Escholz called it when first observing it, — the *Cladothamnus pyroliflorus*, Bong. $\left(9\ \frac{p}{q}\right)$! A beautiful *Dodecatheon* with flowers of a carmine colour, merging into blue, abounds amongst the grass of the higher meadows $\left(14\ \frac{p}{q}\right)$.

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PLATE IV.

UNALASCHKA.

A PLAIN ON THE SHORES OF ILLULUK BAY, AND PART OF THE ADJACENT HEIGHTS.

August.

It is well known that the Aleutian Islands, notwithstanding their large superficial area, are quite destitute of trees, and strongly contrast with the woody mountains of the continent. The climate of Unalaschka, notwithstanding the slight difference in latitude, is much more severe than that of Sitka. The reason may be that the whole of these islands are totally unprotected against the north, and their irregular shape does not even shield their southern side from northerly winds. The steep and rather high mountains, of which the whole country consists, appear like a genuine though rather irregular network of cones, the height and sloping of which are of course very diversified, and amongst which there are in the interior long but narrow valleys without plains. Real plains, of the extent of that seen in our illustration, are common about the shores of the deep bays; they have quite the character of alluvial soil, and above them suddenly tower steep masses of rocks. These plains are generally covered with luxuriant grass, alternating with the almost inconspicuous raspberries and dwarf willows. Up to a considerable distance the heights themselves are clad with a rich turf, the growth of which gradually diminishes with increasing altitude. Still higher commences an Alpine flora, diminutive, mossy-looking shrubs, amongst them small willows, *Rhododendron Kamtschaticum*, &c., whilst the highest summits of the mountains near the shores (about 2000 feet elevation) exhibit nothing save the bare slate rocks, stripes of perpetual snow, and here and there a few isolated Alpine plants. Only on the steep slopes of this upper region, especially in the furrow-like valleys so common there, grows the lupine here figured; it is quite as bushy and tall as on the shores below, though it is not regularly met with in the intervening districts. The still higher mountains, which want of time prevented us from visiting, appear

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PLATE IV.

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from a distance to possess quite the same character as here described, so far as they were not covered with uninterrupted fields of snow The exact snow-line it would be rather difficult to determine, the irregular surface of the country and the influence of the volcanic element on the temperature of the soil making the character of the mountains appear chaotically mingled. Thus we found close to the sea, though it was August, great masses of snow, which probably never disappear.* The shrubby Alpine flora, principally known by the charming little *Rhododendron Kamtschaticum*,—the dark red blossoms of which generally occupy more space than its woody parts,—the region of rhododendrons, often attains but a low elevation, whilst in some localities herbage and the larger shrubby willows are growing gregariously at a much greater altitude. The extreme foreground of our plate represents the gravelly shores of the innermost part of Illuluk Bay. A gregariously growing *Carex* of a dark green chiefly covers large patches of gravel, alternating with different littoral plants, amongst them fine yellow *Compositæ*, peculiar to the whole zone, the geographical range of which is proverbially great. A few steps further inland commence those extensive thickets of herbs, which tinge those parts of the shores not penetrated by the saline particles of the sea. Amongst them predominates a socially growing aconite with dull green foliage, the numerous dark-blue flowers of which are a peculiarity of the landscape. Mingled with it is a smaller allied species, and the fine *Heracleum lanatum*, the umbels of which are very conspicuous near the shores, especially about the rocky slopes; the beautiful *Epilobium angustifolium*, though it may be only in isolated specimens or small groups, and a tall gregariously growing *Artemisia*. Very common, but highly characteristic, is the lupine, easily recognised in our picture, and, as already mentioned, found in isolated specimens on the slopes of the highest mountains. Its fine light-blue and white flowers, alternating with those of aconites, contribute to some extent to the blue tinge which the shores exhibit about this time. Several *Carices* and a number of beautiful grasses principally form the turf of this country.

* During my repeated visits to the Arctic region, I observed similar masses of snow at the seaside, which did not melt during an entire summer, but disappeared in the following or third season, when the plants, so long buried, would instantly resume their operations of life.—*B. Seemann.*

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PLATE V.

ISLAND OF UALAN, CAROLINE ARCHIPELAGO.

MANGROVES.

December.

Of the characteristic forms of the mangroves we met fine specimens in this island, lat. 5° N. This kind of forest covers the shores of the tropics as reeds and bulrushes do the margins of our inland lakes. In this climate, wherever the shores are formed by swamps, *i. e.* principally at the mouths of rivers and rivulets, and at the same time protected from the surf, this form of vegetation may be expected. It appears to attain its perfection and show its peculiarities most nearest to the equator, but every continent (or every one of those large longitudinal sections) possesses its own species to form these groves. They are composed, generally speaking, of the genera *Rhizophora* and *Bruigiera*, trees of indifferent height, growing upon a soil which, as a rule, is at least during high tide covered with salt water, and throwing out numerous aërial roots. On the Indian coast are associated with them species of *Sonneratia* and the stemless Nipa palm (*Nipa fruticans*, Thunb.), which exercise a marked influence on the physiognomy. All these plants exhibit a decided tendency towards gregariousness, quite contrary to the common character of the tropical forests. These groves are also, it would seem, destitute of the numerous creepers seen in their immediate neighbourhood.* In Ualan, and, as far as we could judge from a distance, in the larger island of Funopet, it is not so much the true mangrove trees (*Rhizophora* and

* Perhaps *Entada scandens*, Bth. (= *Mimosa scandens*, L.) forms the only real exception I can call to mind. I have seen festoons of this creeper several hundred yards long in the mangrove swamps of Fiji. *Guilandina Bonduc* and *Tephrosia piscatoria*, though sometimes throwing their branches over mangrove trees, if they happen to grow close to soil above high-water mark, cannot be classed with the real swamp vegetation of which the author here treats. They belong, properly speaking, to the vegetation immediately following the mangroves, composed of *Barringtonia speciosa*, *Calophyllum inophyllum*, *Hibiscus tiliaceus*, *Thespesia populnea*, &c. — *Berthold Seemann.*

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PLATE V.

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Bruigiera) which impart to the forests their physiognomic character, but rather a species of *Sonneratia*. Whilst those form only low woods, this beautiful tree attains as considerable a height as most of the forest trees of the neighbourhood, spreading out the more stately as it does not form a regular stem, sympathising as it were in a neighbourly way with the Nipa palm; from its root rise several equally strong and diverging stems, the lower branches of which, with their dense foliage, almost touch the water, and the whole, so to speak, represents a huge shrub. The dark bark of these colossal masses of wood forms a fine contrast with the pale green foliage, the almost circular leaves of which have an especially cheerful look. As long as these trees are in full vigour they are only here and there covered with patches of dark green moss, an ornament rather in contradiction with all other features as reminding us of our northern forests (7 c). But, as soon as they begin to die, their trunks are covered with a number of fine epiphytical ferns (3 b). Another singular feature of these trees are the wooden pegs which, covered with a dark brown bark, rise to the height of about one foot, wherever the ground is not under water. We have not been able to discover the significance of these excrescences, which everywhere appeared to have the same form and look; they seemed to be connected with the deeper lying roots of the *Sonneratia*, of which we could not observe any other stage of development. The stems of the *Rhizophora* of this place generally grow quite erect, upon a scaffold of aërial roots, almost as in some species of *Pandanus* (1 | 2 d; 9 | 10 d). Just above this scaffolding the branches diverge, mostly in a horizontal direction, sending roots downwards, which are covered with the same kind of bark as the branches themselves. These roots look like turned pipe-stems, never have any excrescences or irregular bents, and firmly establish themselves as soon as they reach the ground, but they never form new stems, as is the case with the great fig-trees; their object seems simply to assist propping up the tree. The *Bruigiera* (also, as far as I know, where only represented by one species) is less social, and attains for the most part a much greater height than the *Rhizophora*, with which, however, it otherwise completely corresponds in the shape of the leaf and in the formation of the smaller branches. But, on the whole, its growth is more irregular and more resembles that of the common deciduous trees; its aërial roots also are less numerous and grow differently $\left(5\,\frac{e}{f}\right)$. Such groves encircle, with a few interruptions, the shores of the island of Ualan, just above the surface of the water. Where the coral reef surrounding the whole island is so low as to permit the waves to strike the land, a sandy beach is formed, with a vegetation resembling that of the coral islands: but

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where, as is the case in most places, there is between the reef and the shore an extensive sheet of shoal water to protect the land from the surf, the mangrove forests are far advanced into the salt water. They are crossed by river-like channels, serving as highways for boats, and as footpaths for passengers. Imagine the centre of our picture to be one of these channels, and the foreground the mouth of a little river. The occurrence of the plants here shown favours this conception, for they are more in need of fresh water than is the *Sonneratia*, which often forms at a considerable distance from the shore, quite surrounded by salt water, isolated, highly picturesque groups. In the foreground will be observed a tree, the curiously shaped and widely spread roots of which indicate the banks of such rivers as terminate in the sea (13 k). It is a species of *Balanopteris*, and similarly formed ridges of roots have been observed by us also in other islands, especially in Luzon, but nowhere else of such height and dimensions. This peculiar labyrinth, formed of walls of gradually decreasing height, surrounds every tree. The comparatively thin walls consist of a tough kind of wood, covered with a soft, smooth, greyish-brown bark. By striking one of them, a hollow drum-like sound is produced, audible at some distance. The foliage of the tree is of a greyish-green colour, often covered with little epiphytes (*Jungermanniæ?*), whilst the smaller branches are clad with lichens and mosses, and the larger, as well as the stems, with fine ferns, so common about here. Amongst the latter the well-known *Asplenium Nidus* is conspicuous on account of its crown-like growth $\left(5 \mid 6\frac{c}{d}\right)$.* Here it represents physiognomically, as in the greater part of Polynesia, the numerous *Bromeliaceæ*, which decorate in a similar manner the trees of tropical America. The *Tillandsias* of that country find their representatives in the riband-like drooping ferns, which form as it were long waving veils. Extreme elegance of form in these epiphytes makes up for (what the American possess) want of gay flowers and variety. They are always of a fresh lively green, darker or lighter, whilst those of the New World often have a bluish-grey tinge, which renders the *Tillandsias* so much like our northern *Usneas*. Altogether there are amongst the

* I have never been able to perceive anything resembling a nest in the aspect of this plant, as is said to be the case in the American *Asplenium Nidus*. Perhaps under this name are enumerated several quite distinct species, which possibly it may be difficult to distinguish in the herbarium. [The author is quite right in supposing that there are several distinct species comprised under the name of *Asplenium Nidus*, but I am surprised that he should have failed to perceive the striking resemblance these plants bear to birds' nests when considered as a whole. They have exactly the shape, the leaves, disposed in a circle, forming the sides; and the masses of dead leaves falling into the centre seem to render the comparison with a nest much more striking than with an antique crown or head-dress of an Indian chief.—*Berthold Seemann.*]

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epiphytes of this island very few phanerogamic plants. In conclusion, we must cast a glance at the beautiful *Nipa* palm, which, at least above the ground, never exhibits a trunk.* The few young plants can give only a poor conception of the stately appearance of the fully grown ones occupying exclusively entire districts. The only fully developed specimen, which space would permit me to introduce, exhibits the peculiar formation of the spadix, so closely resembling that of most species of *Pandanus;* it is quite woody, and of a rusty-brown colour, whilst the flowers, appearing simultaneously, incline towards a reddish-yellow tinge (14 | 15 l).

* According to Teysmann (Bonplandia, vii. p. 122) the trunk, about a foot thick, creeps horizontally in the mud, throws out numerous little roots, and *becomes divided into several branches*, whilst its lower extremity gradually decays and becomes exposed, without injury to the plant as a whole; new roots, continually forming as the trunk increases in length, provide for the general nourishment. This, with the exception of the branching, is exactly the growth I observed in *Elaïis melanococa*, Gærtn., and *Phytelephas macrocarpa*, R. et Pav. in Darien.—*Berthold Seemann.*

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PLATE VI.

UALAN.

SWAMPY FOREST, WITH BANYAN TREES.

December.

IMMEDIATELY adjoining the mangroves is a description of forest peculiar to the tropics. The adjacent ground, just above high-water mark, becomes inundated in consequence of the high tide forcing back the water about to be discharged by rivers and rivulets. A soil thus periodically submerged, of course, never becomes dry, and only somewhat firm by the gigantic roots of the trees occupying it. In Ualan, these swampy forests have a twofold character. Where the underwood consists of the creeping *Hibiscus populneus*, they are almost impenetrable; where this is wanting, there is, under the huge bower formed by the crown of large trees, a wider prospect. The underwood is composed of numerous small trees, the crowns of which have not been able to attain the height of the larger trees, and therefore remained undeveloped. The greater number of them belong to *Barringtonia acutangula;* the fine drooping bunches of flowers were often seen on the ground. The stems are decorated with epiphytical ferns; amongst them most prominent, *Asplenium Nidus*. It is seen everywhere at a greater or lesser height, and imparts a striking character to the landscape. No less elegant ornaments are the isolated *Freycinetias*, which in Ualan are mostly growing epiphytically, and replace by their long stems the great orchids of the West Indies. They are shown quite in the foreground of the picture $\left(10 \mid 11 \frac{i}{k}\right)$. On the left is a large *Cordia*, of which, however, only the stem, surrounded by the smaller ones of *Barringtonia acutangula*, is visible. The principal figures are several gigantic fig-trees, such as are often met with in these forests. Those here illustrated may be assumed as having established, above the heads of other trees, a connection with each other by means of their branches, as is common in this kind of plants throughout India, where they form entire forests, the stems of which are connected. These are the

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PLATE VI.

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far-famed banyan trees, regarded as sacred in some places. Amongst the wonderful phenomena of the vegetable kingdom, as displayed in the tropics, they occupy the foremost place, and the botanist pauses before them, as the geologist does before some rocks, in order to decipher the hieroglyphics of their formation. The most striking peculiarity of these trees is their aërial roots, which, springing from the bark, grow downwards, often from a considerable height, but as soon as they touch the ground they enter it and form a new stem. They also have, in a prominent degree, a tendency of growing together as soon as their different parts come in contact with each other (as is the case in other plants, especially some creepers), which causes that extremely fantastic shape generally observed in these trees.* The present species differs from other kinds of banyan with which we became acquainted, not only in its astonishing height (our illustration shows only the lower parts of the stems), but especially by its drooping aërial roots appearing in bundles of tender, originally disconnected fibres, which gradually grow together, and, after reaching the ground, increase in thickness, by which the new stem soon loses, more or less, all traces of its original formation. The height of the whole is so considerable that the crowns reach above that of other trees, and here and there form as it were a forest above a forest, often visible from some distance. The spectator, standing below, soon loses sight of the upper parts of the tree, and only notices accidentally the connection existing amongst trees which at first view would seem to be perfectly unconnected. In vain I attempted to introduce in the original drawing something of the foliage of this tree†; of the crown little was visible, and the leaves appeared to be comparatively small and of roundish shape. All the young saplings growing about here, and bearing leaves, were those of the *Barringtonia acutangula*, which does not disdain to assume an epiphytical character on these large masses of wood. The often-mentioned ferns here abound. The bark of this colossal tree is very soft, and of a brownish-yellow colour, whilst the young roots, as long as they are not metamorphosed, are more of a rusty brown. There is also a strong, spiny reed, which at first sight was thought to be a *Pandanus*, but which belonged to the *Cyperaceæ* $\left(1 \mid 2 \frac{g}{h}\right)$. It grows here gregariously, but isolated, in the higher parts of the island, especially on rivulets in forests.

* These creepers sometimes form a kind of network around large stems of trees, and seem to grow more or less together with the bark. Something of this sort is shown even in the present illustration, on the left side of the foreground, at the base of the stem of the large *Cordia*.

† It will be necessary to add that the stem was even more densely covered with *Barringtonias* than could be shown without rendering the drawing unintelligible.

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PLATE VII.

UALAN.

VEGETATION OF A VALLEY, AND OUTSKIRTS OF FOREST.

December.

On ascending another step, where there are no longer any periodical inundations, the vegetation assumes a new feature. The level land of the valleys has been brought into a certain state of cultivation, being planted, without previous labour, with those products of the island which principally furnish food to man. These plantations are so much favoured by the extreme fertility of the heavy soil, for the irrigation of which Nature so liberally provides, that they interfere little with the original aspect of the island. Bread-fruit trees, bananas, two gigantic species of *Caladium*, and the Tahitian sugar-cane, grow here so intermingled that there is some difficulty in determining whether there has been an arbitrary transplantation or not, especially as most of these plants readily propagate themselves by suckers, it being generally quite sufficient to put a slip, just torn off the parent plant, into the fertile ground, in order to propagate it. We observed only in one kind of plantation a certain arrangement, properly defined field, and on the whole a greater amount of care; it being that of the above-mentioned sugar-cane, which, however, is seen in great abundance, perhaps naturalised, amongst other plants. The cocoa-nut palm deserves particular mention, although not very common, and to all appearance not indigenous in the island, but introduced by man, and still kept in a state of culture. One would be inclined to suppose the same with regard to the bread-fruit trees, abundant though they be, as we did not see amongst the numerous fruits a single one having properly developed seeds. This seems to point to a change brought about by cultivation; but the irregular manner in which the trees occur in the forests looks as if they had been dispersed by Nature's hand, and argues against the supposition. Is the fruit of the wild trees really furnished with seeds, and is it only eaten when necessity demands? We did not remain long

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PLATE VII.

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enough in the island to gather information on this head.* We only noticed two equally common varieties of the fruit, the one being oblong, almost the shape of a pumpkin, the other rather smaller and nearly spherical. The two are not produced on one and the same tree; the round one has a rather more solid fibre: otherwise we could not perceive any difference either in the look or taste of the fruits, or in the shape of the leaves. The tree here illustrated (2 a) is quite a young specimen, just beginning to bear fruit. The bananas of this place belong to four varieties, the specific type of which are *Musa paradisiaca* and *Musa Sapientum*, the one having nodding, the other erect heads of fruit.† The larger variety of the former (6 e) is called "*Ush*," plural "*Ushua*;" it is the best-flavoured of all. The smaller is termed "*Kirreh*," and its fruit is preferred when baked. The larger variety of the second species (13, *n*; 15, *n*), having a soft, pulpy flesh, of poor flavour, is known by the name of "*Kalash*," and the smaller "*Kalanton*." All four differ, as far as I could make out, only in the shape and nature of their fruit. Of the two larger *Caladiums* (8 f; 9 f) it is principally a species allied to the well-known *Caladium macrorhizum*, the root of which furnishes a nutritious and palatable article of food. Still more nutritious and palatable is that of a third $\left(14 \mid 15 \frac{p}{q}\right)$, which we could take for nothing else than the widely diffused *Caladium esculentum*. Its leaves have a bluish tinge, whilst those of

* Most bread fruits—and their variety is almost as endless as that of our apples and pears—have abortive ovules, and therefore do not produce any seeds, a peculiarity which gives them the advantage over the few sorts in which the ovules are fertile, and assume considerable dimensions at the expense of the edible pulp. Not only are there great distinctions in the nature of the pulp (as there is in the nature of the tubers of the potato, that of some being mealy, of others waxy, &c.), but also in the time of ripening, there being early and late sorts. Important characters of distinction reside in the foliage; some leaves are quite entire, —I do not here confound *Artocarpus integrifolia*, the well-known jack fruit, with *Artocarpus incisa*, — some pinnatifid, and again others bipinnatifid. The shape of the fruit, whether it be oblong or more or less spherical, its surface, which passes through the various stages from smooth to soft prickles three quarters of an inch long, its size, the nodding or erect tendency of the peduncle, the greater or less fibrousness of the bark (for making cloth), the greater or less heaviness of the wood, and the amount of gum exuded by the stem and branches, must arrest the attention of all those who make this subject their study. Bennett ("Gatherings of a Naturalist," London, 1860, p. 396) found twenty-four varieties in the small island of Tahiti; Fiji and other Polynesian islands are equally rich. No attempt has as yet been made to identify the different varieties scattered over the whole eastern hemisphere. — *Berthold Seemann.*

† This is evidently a mistake. The Musa with *erect* bunches of fruit has nothing to do with either *M. paradisiaca* or *Sapientum*, but is the well-known *Musa Troglodytarum* of Linnæus, of which the *Musa textilis* (of which the delicate Manila handkerchiefs are made) may be a variety. The Samoans say that at one time all the Musas had a great fight, in which *M. Troglodytarum* came off victorious, and was able to hold up its head, whilst all the vanquished ones could never muster up courage to raise it after their defeat. Our author also uses the term "*bananas*" collectively for all the species, whilst it is more generally restricted to those kinds which may be eaten raw, and that of "plantain" to those which require to undergo some process of cooking before they can be eaten.—*Berthold Seemann.*

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the larger species are of a fine green. All, but principally the first mentioned, exhibit, when closely examined, a great elegance in the texture of the leaves. Although the smaller species ("*Katak*") is highly esteemed as an article of food, it is nevertheless nowhere planted in greater masses, probably because it grows wild in sufficient abundance. As far as we could see, all three species occur in forests of the uninhabited parts of the island, on the banks of rivulets, and not gregariously, and therefore do not seem to have been introduced. The larger species, with rounded leaves, often forms a trunk, but that with pointed leaves (*Caladium sagittifolium*) (6 f) does not; in the former the spadix is erect, and shorter than the spathe, whilst in the other it is nodding, as is the peduncle supporting it. *Pandanus odoratissimus* (14 | 15 k), as a highly characteristic figure, can as little be dispensed with in such a picture as the bread-fruit tree. One would think that the reason why it principally occurs and flourishes near human habitations, may be sought in its claiming a place amongst the useful plants of this place, perhaps on account of its leaves being indispensable for thatch and matting. But also its fruit, though its nutritious qualities are slight, seems to be much esteemed in Ualan, as was evident from the importance attached to those presented to us. This fruit, or rather head of fruits, has, when ripe, a very fine appearance; it is larger than a man's head, round, and of a splendid orange colour, each drupe being pale green at the point. This tinge, and the crown of leaves, recall to mind the pine-apple.* Close by will be seen the *Morinda citrifolia* (12 | 13 m), abounding in these valleys; it does not grow much higher than the specimen here shown. The fruit ripens about this season; it is of a whitish colour and a poor flavour, whilst the foliage is distinguished by a pale green. A kind of orange tree (8 | 9 e) is generally associated with it; attaining only a limited height; it has, unlike most of the trees, a thick bushy crown; the colour of the foliage is a dark green. The same tint was common to its fruit, much esteemed by the natives, but about this season scarcely ripe. To the most prominent plants of this island belongs the widely diffused *Dracœna terminalis* (12 o; 15 o), commonly used for hedges, and imparting to the dwellings a picturesque appearance, which the variegated tint of the leaves greatly contributes to increase, it being a faint bluish green, and at the points of the blade pink and pale yellow. A fine *Crinum* (3 g), with massive leaves, grows isolated about the outskirts of the forests, but I do not remember having seen it in bloom.

* The Fijians, having no name for the pine-apple when it was first introduced to their islands, made the same apt comparison as our author, in terming it *Balawa ni papalagi*, or foreign Pandanus.—*Berthold Seemann.*

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A *Maranta* (5 | 6 g), growing gregariously, abounds. Its bracts are of a dark rose colour, and the flowers small and yellow. In company with it is often found a highly characteristic plant, of which, unfortunately, I do not possess a representation, but which I cannot pass over without mentioning. It is the *Piper methysticum*, so frequently described, a perennial with large roundish leaves, from the root of which a liquor, here called "*Seka*," and evidently of a religious import, is prepared.* The background exhibits another characteristic feature of tropical vegetation, viz. the outskirts of a wood as seen from without. Such outskirts are generally formed by low trees and by shrubs, and show a greater variety of forms than even the interior of the forest itself. Here in this island, so widely separated from other countries, it is principally the gregariously growing *Hibiscus populneus* which, chiefly constituting the underwood, combines with the dwarfish stems of a new and very common *Myristica* (4 b) in forming the scaffolding for the impenetrable curtain of creepers of which these outskirts chiefly consist. In the valleys of the higher mountains this *Myristica* ("*Nuhn*") is generally a stately forest tree of first magnitude; here, as shown in our illustration, it is too much checked in growth by a surrounding web of creepers, out of which it stretches its branches like arms, to attain any considerable dimensions. The most elegant festoons formed by these creepers are about this time decorated with the dark blue flowers of a *Convolvulus* common about here, and forming a charming contrast with the pale yellow ones of the *Hibiscus populneus*, closely resembling the mallows of our gardens. Above this drapery towers a tree principally belonging to the outskirts, the widely diffused *Terminalia Catappa*, or at least a species closely allied to it (6 b). Its horizontal branches form distinctly marked stories around the erect stems, imparting to the tree, and by means of it to the landscape, a very peculiar feature. We never found this characteristic growth better developed than in this island. The leaves are of a dark green. (In Guaham we saw them assume a red colour, in consequence of the dry season.†) The top of a tree projecting on the right-hand side of the background may perhaps belong to the same kind of *Cordia* of which the stem is seen in our last view. A fine specimen of tree fern, in which

* This beverage is termed Kava or Ava in most islands of Eastern Polynesia; in Fiji it is known as "Yaqona." — *Berthold Seemann.*

† The branches of *Terminalia Catappa* may be more appropriately described as being distributed in whorls, imparting to the tree a *coniferous* look. The Fijians and other Southern Islanders aid the horizontal tendency of the branches by placing weights upon them. The foliage, at first dark green, gradually becomes yellow, brown, and ultimately scarlet, a change reminding us of that observed in so many North American plants, which gives the woods of Canada and the United States their great charm in the autumn. — *Berthold Seemann.*

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this island is eminently rich, is ornamenting the outskirts of the forest (7 | 8 d). This form becomes more abundant on the slopes of the mountains; especially on the steep edges of them may be seen, even from a distance, their palm-like crowns rising above low brushwood. Still more abundant, and especially rich in species, is a form of colossal ferns, which, though making regular crowns, does not have a genuine trunk. These are also more numerous in the forests of the higher mountains, and more isolated on the outskirts of the lower. The largest of the two kinds here illustrated is distinguished by its highly elegant fan-shaped leaves, and termed "*Payoa*" by the natives $\left(3 \mid 4 \frac{f}{g}\right)$. The turf seen in the foreground is formed principally by a few creepers, amongst which a species of *Cucumis* is the most common, the round fruits of which, pickled in vinegar, we took a great way to sea with us. Its small yellow flowers are about this season seen everywhere on the ground. Together with it is commonly found a small species of *Piper* with pointed leaves, which also climbs up the trees and contributes towards the formation of the above-mentioned festoons. A variety of smaller ferns are decorating this turf.

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PLATE VIII.

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PLATE VIII.

UALAN.

WOODY MOUNTAINS.

December.

The last plate represented the outskirts of a forest seen from without; this will exhibit them as seen from within. It has at the same time the character of a somewhat higher mountain district, which, however, as has already been stated, does not differ materially from the thickets common on the sea-shores, as the island is but of limited extent. The prevailing wood is the creeping *Hibiscus populneus*, the peculiar growth of which arrests attention. Most of the horizontally directed stems send up branches having the shape of straight poles, gathered by the natives for a variety of purposes. Fantastically curved branches and branchlets are, as the illustration shows, never wanting, especially such as have the form of a hook, and they seem to serve as pegs for the support of the numerous creepers flourishing in these thickets. These little excrescences are without leaves, and differ from the principal branches by having a dark and rough instead of a pale yellow bark. In these thickets the screw-pine (*Pandanus odoratissimus*, Linn.) is occasionally seen isolated as underwood of considerable height. The higher the ground the more abundant and prevalent become the larger ferns, the crowns of which are not inferior to those of tree ferns, though they have no trunk, properly speaking, as for instance the genus *Marattia* $\left(13 \mid 14\,\frac{m}{n}\right)$. The ground is besides covered with various herbaceous creepers, the dead stems of which, forming dense curtains, are hanging down from the trees. But those rich festoons, which we have already seen in our last view, generally consist of the above-mentioned *Convolvulus*, intermingled with a species of *Stizolobium* and *Piper*. The woody creepers, the stems

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of which are sometimes an inch thick, nowhere show, at least about this season, leaves or branches, but run through the whole forests like so many ropes; they are especially attached to the crown of old trees, and quite tight, as in a well-trimmed ship. Highly picturesque are their numerous twists, and the chains and plaitings which they form amongst themselves. All these leafless creepers, as far as we could see them, were of a dark chocolate or dusky colour, generally full of sap, and extremely tough and flexible. Amongst the forest trees the already mentioned *Nuhn* (*Myristica sp. nov.*) occupies a prominent place, and, on account of the peculiar formation of the branches, its foliage arrests attention $\left(15\,\frac{k}{l}\right)$. A fine *Eugenia*, the flowers of which (here ripe fruit) grow out of the stem, belongs to the characteristic plants of this upper region. In that below, near the sea, it occurs but rarely, and is of diminutive dimensions. Unfortunately I had no time to draw a fully developed specimen, and have therefore been obliged to content myself with introducing a rather weak one; the plant attains much greater height and thickness. The fruits, either isolated or picturesquely grouped, look somewhat like cherries, but are larger and either white or red. They are fleshy, but hard and inedible.* Two monocotyledons, already incorporated in the last view, could not have been left out here, *Dracœna terminalis* † $\left(10 \mid 11\,\frac{m}{n}\right)$ growing in small groups amongst the creepers, and a *Maranta* $\left(14 \mid 15\,\frac{p}{q}\right)$. Close by the latter generally flourishes a species of *Costus* (4 h). The slender palm (13 | 14 k) is apparently a young specimen of a very fine species, rather common, though isolated, in the higher mountain regions of this island. Its very straight trunk attains a considerable height, enabling one from the sea to distinguish their crowns above the general level of the forests in the mountains. Want of time prevented us from forcing our way through the jungle as far as that locality, but lower down this splendid plant, termed "*Kutuar*" by the natives, does not seem to be found. I remember having only been near it when, led by native guides, we were on a road, steep and difficult to trace, which led through the interior of the island to the Bay of Läla. The first specimen met with on that mountain road is the one introduced; I have drawn it as carefully as time would permit. A second and much finer one was encountered after having de-

* Possibly the fruit may not have been quite ripe, and hence appeared inedible; otherwise the description here given may be reconciled with *Eugenia* or *Jambosa Malaccensis*, of which there is a red and a white variety. — *Berthold Seemann.*

† Probably an allied, but different species. — *Berthold Seemann.*

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scended the other side of the mountains. It bore fine white flowers. Its crown seemed to be considerably denser and rounder than that of the young specimen, and the general habit that of the *Areca* palm. Unfortunately it was already too late, and the haste of our guides to reach Läla too great, to allow of my making a drawing of this plant, which stood upon such inaccessible ground that an attempt to fell it and gather its flowers would have required still more time. Of course this leaves it somewhat doubtful whether the one here represented is only a young state of it, or quite a different species.

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PLATE IX.

CORAL REEF OF LUGUNOR, CAROLINE ARCHIPELAGO.

VIEW OF A WOODY CORAL ISLAND, SEEN FROM WITHOUT.

February.

IMAGINE a generally horseshoe-like chain of comparatively long, narrow sand-banks, hardly elevated above the level of the ocean, sheltered against the waves by a coral reef surrounding the whole. Everywhere within the latter the water is shallow; the bottom, consisting of coral sand, is evidently rising and gradually becoming dry land, so that the open narrow channels crossing the long ridge of land, and dividing it into several islands, will in time disappear. The present view represents one of these channels. Standing at the extremity of one island, we look across upon the other; on the right we have an expanded view of the reef, distant about 200 paces, and behind it the surf of the ocean; on the left we behold the basin of unequal depth, surrounded by the horseshoe-like chain, where the prospect is closed by a few islets of this self-same chain. Such coral islands, but recently risen above the surface of the ocean, exhibit of course no trace of the vegetation which establishes itself on the older ones. The first green appearing on the hitherto naked sand, we found to be invariably the shrubby *Scævola* with small white flowers, which afterwards forms also the principal brushwood of the shores; a specimen of it is represented in the centre of the foreground (6 g), and there is no difficulty in recognising it by its habit in the more distant groups of bushes. The rich juicy foliage of this plant may be well suited to the formation of vegetable mould, in which a more diversified vegetation finds a home. Next follows a *Tournefortia*, common in all the islands of these seas visited by us, which assumes more the look of a small tree, and has a less bushy habit; the silvery grey colour of its leaves forms a strong contrast with the fresh light green of the *Scævola*. A young specimen of this exclusively littoral

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PLATE IX.

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plant is seen on the right-hand side of the foreground $\left(11 \frac{p}{q}\right)$, and an older one more in the distance $\left(13 \frac{n}{o}\right)$.* Close by will be noticed the delicate foliage of another shrub, peculiar to the outskirts of these forests, which, according to Dr. Mertens, probably belongs to a new genus of *Myrtaceæ;* an old fully grown specimen of it is seen in the foreground to the left $\left(2 \mid 3 \frac{d}{e}\right)$. In the outskirts of the forest at a distance are found, besides the exclusively littoral plants, other half-shrubby trees. Two specimens of *Pandanus odoratissimus,* so common in all these islands, will easily be recognised by their peculiar habit. Their trunks here exhibit numerous crowns. On the right-hand side of the smaller specimen to the left are seen, besides the low *Scævola* and that undetermined *Myrtacea,* a species of *Hibiscus* with cordate leaves and dark carmine-coloured flowers, which either occurs as a shrub or small tree $\left(7 \mid 8 \frac{e}{f}\right)$, and above it a *Calophyllum* † (8 e) which in other places becomes a stately forest tree, and has a dark green foliage. Immediately behind it rises an isolated cocoa-palm, and more to the right (12 n) a young specimen of *Barringtonia speciosa,* one of the most elegant trees of this region, but which grows less freely in these coral islands. Groups of cocoa-nut palms, which suffer little underwood to spring up, show themselves here, and through these may be seen the other end of the forest, a proof of the limited extent of such an island as this. In its centre, where the accumulation of vegetable mould has been going on the longest, two stately forest trees have already found a home. I only distinguished two species, which probably may be the most common and conspicuous. The first, a specimen of which closes a group of trees, is a large *Eugenia* with lanceolate leaves, about nine inches long, and fruits of about the size of a large plum, of a pale green colour tinged with red, of a sweet, insipid, yet refreshing taste, and very much esteemed by the natives. Several bread-fruit trees (*Artocarpus incisa*), of considerable height, follow. Here may be found the true type of a tree in a state of cultivation in most of the larger islands, all the fruits having fully developed seeds of the size of chestnuts, and a similar skin. Roasted, they are eaten, possessing very much the taste of chestnuts. There are besides several varieties of the bread-fruit, principally distinguished by the shape of their leaves, as we shall have an opportunity of learning on noticing the succeeding view.

* Doubtless *Tournefortia argentea.* — *Berthold Seemann.*

† Probably *Calophyllum inophyllum.* — *Berthold Seemann.*

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PLATE X.

LUGUNOR.

VIEW OF A WOODY CORAL ISLAND, SEEN FROM WITHIN.

February.

THE stately bread-fruit trees seen at a distance in the last plate are in the present brought so near that it was impossible to include their tops. To man they are the most conspicuous and important of the vegetable products of these islets, and they only flourish where masses of vegetable mould are already accumulated. In the foreground we see two of the numerous varieties of this fine tree alluded to in the foregoing chapter: on the right $\left(13 \mid 14 \frac{m}{n}\right)$, one with slightly cut leaves; in the centre $\left(10 \mid 11 \frac{m}{n}\right)$, the other, the leaves of which are more deeply cut. According to information collected by Dr. Mertens ("Voy. du Seniavine," vol. iii.) the former is termed "*Mai*" in Morilho and Fananu, the latter "*Oness*," and said to be the type of the wild plant, unchanged by cultivation, and the only one bearing fully developed seeds. As far as I know, there were in the Lugunor group in February many ripe bread-fruits, all of them with seeds, but the variety with deeply cut leaves was by no means common, and seemed to be attended to and esteemed quite as much as the others. The fruit with seeds was generally round, rather smaller than the round variety in Ualan, and had a flavour resembling that of the latter, but less fine, and the fibres were not so tough.* No less important than the fruit is the wood of the bread-fruit tree to the inhabitants of the coral islands, of which not only canoes, but all kinds of household articles, even cooking apparatus, are made; water being about here brought to the boiling point by throwing heated stones into it. The plank-like

* There are several varieties of bread-fruits in which the ovules become developed, which fully reconciles the above apparently contradictory statements. — *Berthold Seemann.*

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PLATE X.

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excrescences of the stem, observed above the roots, are skilfully turned into boards and planks, which otherwise would be difficult to construct with the rude tools here in use. The two human figures introduced in the corner of our illustration may be presumed to be the owner of the tree, and a man, skilled in ship-building or other kinds of carpentry, consulted on the best method of turning the tree to account. If it be true what Dr. Mertens states in the above-cited place, that, according to the testimony of a sailor, W. Floyd, the wood of the variety termed "*Oness*" proves too heavy for ship-building purposes, it would seem to point to an essential difference of this from other bread-fruit trees, and perhaps indicate a new species. On the left-hand side $\left(3\ \frac{d}{e}\right)$ something is shown of a tall *Eugenia*, apparently the same as the one termed "*Kiriar*" in Ualan. In the same place of the foreground $\left(4\ \frac{d}{e}\right)$ is seen a young cocoa-nut palm, belonging to the thickets of this side of the shore, whilst the two high specimens in the background indicate those of the other side. *Pandanus latifolius* $\left(7\ d;\ 9\ \frac{f}{g}\right)$, occurring isolated in Ualan, generally is common in the coral islands; it differs from *Pandanus odoratissimus* not only by a more elegant growth of its broader leaves, but also by its fruit, which, when ripe, is whitish, and has very hard though edible drupes; its round heads of fruit, attached to longer stalks than those of *Pandanus odoratissimus*, are generally drooping $\left(12\ \frac{l}{m}\right)$. A young shrubby specimen of *Barringtonia speciosa* grows close to the above-mentioned cocoa-nut palm $\left(5 \mid 6\ \frac{e}{f}\right)$. A species of *Guettarda** forms middle-sized trees; we see a fully grown specimen of it (9 m), and more in front a young one (12 n). At the foot of the former, several delicate creepers form a rather rich curtain. Amongst the finest flowers of this season rank the dark blossoms of a species of *Crinum* (2 f), with which the inhabitants ornament their hair and ears. *Tacca pinnatifida* $\left(11\ \frac{p}{q}\right)$ grows plentifully, though ungregariously, on the outskirts of the woods.

* Probably *Guettarda speciosa*, Linn., common on the sea-shores, the geographical range of which extends from India to the Fijis.—*Berthold Seemann.*

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PLATE XI.

GUAHAM, ONE OF THE MARIANNE ISLANDS.

FOREST IN THE PLAINS OF MADREPORE, OROTÁ PENINSULA.

March.

As far as the Mariannes are represented by Guaham, the most extensive and southernmost of these islands, they are at once distinguished from the more northern Caroline group by their dry climate, which imparts to the whole country the look of a steppe. The month of March, in which our visit fell, is evidently the dry season of these regions; everywhere is aridity, very few trees with fresh foliage are seen in the forest, and perhaps the third part of all is quite leafless. The sea-shores are either kept supplied with moisture by rivulets from the interior, and then overgrown with *Bruigiera* and other mangroves, or they are sandy, and in the latter case distinguished by two forms very characteristic of this island, — *Cycas revoluta* $\left(10 \mid 11 \frac{o}{p}\right)$, very common hereabouts, and a shrubby pyramidal *Casuarina**, which is again met with in the upper steppes of the interior, though wanting in the intermediate forest district. Banks of coral surround the shores on all sides, making this larger island, as the high Carolines, appear like mountains risen in the centre of extensive coral plains. Here and there considerable districts of these plains have been lifted by plutonic agency high above the sea level; the Orotá peninsula, confining the south-west side of the bay of Caldero de Apra, is one of these. The low, sandy shores are evidently later diluvial deposits; a few steps from the water's edge the walls of very ancient madrepore rocks rise perpendicularly, the surface of which is as level as most coral islands, and they only seem sloping by the accumulation of vegetable mould. This plain, which, as may be supposed, is utterly destitute of springs, is nevertheless covered with fine tall trees, and, although thorny underwood abounds, is

* Probably *Casuarina equisetifolia*, Forst.—*Berthold Seemann.*

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PLATE XI.

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on the whole tolerably penetrable; however much the growth and features of the trees may recall to mind the virgin forests in other tropical countries, their impenetrable nature is here suspended. True, there are occasionally considerable thickets of luxuriant *Cycas*, as shown in the centre of our illustration, a few old trees of considerable height forming an agreeable contrast with this rather chaotic group of saplings. Amongst them are only a few branching specimens, as seen on the left of our plate $\left(1 \mid 2\,\frac{d}{e}\right)$, and these appear to be very old. Other curious phenomena are the apparently not very scarce hermaphrodite individuals, bearing the rising male flowers, and below the already fully developed fruits.* Amongst the forest trees is one distinguished by its slender growth and thick foliage (the leaves resembling those of the ash), which vernacularly is termed "*Pai-pai*," and esteemed on account of its extremely hard wood. The same remark applies to another tree of similar aspect, the leaves of which are, however, more like those of the myrtle, whilst the bark is pale yellow $\left(9 \mid 10\,\frac{l}{m}\right)$.† A *Pandanus* $\left(6\,\frac{d}{e}\right)$ which, though isolated, is rather common, and, though it does not seem to differ essentially from *Pandanus odoratissimus*, is conspicuous by its habit, its slender undulated branches, and especially by its long narrow leaves, of which there are comparatively few in each crown. Several species of *Cordia* $\left(14 \mid 15\,\frac{k}{l}\right)$ exhibit their gigantic growth, and are about this season but sparingly clad with leaves; here and there their bark is surrounded by a network of certain creepers, already noticed in describing Plate VI.‡ But the most striking of all the trees is a gigantic species of fig, the representative of the banyan in this place $\left(5 \mid 6\,\frac{b}{c}\right)$. It differs evidently in every respect from that of Ualan, the height of which it nowhere seems to attain. Its comparatively tall stem always has the appearance of a gigantic bundle of sticks, the component parts of which must be considered as being curiously twisted around each other, and grown together into one mass. On the upper end of this rather conical bundle, spreads out like an umbrella a crown formed of fantastically twisted branches, which has numerous fine leaves of a dark, rather greyish green. The tree seen on the right-hand side of the

* I take this to be *Cycas circinalis* rather than *Cycas revoluta*. — *Berthold Seemann.*

† These quite unsatisfactory notes are amongst the defects of the letterpress caused by the unexpected loss of our botanist Mertens.

‡ As I am not able to introduce an illustration of them, I must direct attention to the beautiful drawing made by our travelling companion, Postels ("Voy. du Seniavine," Atl. pl. 38), which gives a very good representation of this large species of *Ficus*.

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foreground (12 | 13 l) seems to be a smaller species of fig, the aërial roots of which have quite the look of creepers. Elegant ferns are covering its branches. There is also a species of *Cerbera* *, frequently met in the Caroline, Marianne, and Bonine Islands; it resembles in growth and the shape of its leaves the *Terminalia Catappa*, but its principal branches are more rectangular, and the foliage is generally more airy and of a finer lively green $\left(3 \mid 4 \frac{b}{c}\right)$. I have nothing to add respecting the large-leaved perennial, except that a species of the same genus, resembling it in leaf, grows in the island of Luzon; it has not the thick bushy growth of the present, but makes tall slender stems (4 e). In the centre of our view (7 | 8 f) will be seen a thorny shrub, which about this season is conspicuous by its fresh dark green and large white flowers. For reasons already assigned I am unable to supply its scientific name.

* Perhaps *Cerbera Odollam*, Gærtn., common in this region. — *Berthold Seemann.*

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PLATE XII.

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PLATE XII.

GUAHAM.

LOWER SAVANA DISTRICT.

March.

WHERE the old volcanic soil of the island prevails, the steppe-like character already commences in the narrow valleys adjoining the mangroves. Even in places little favourable it principally shows itself in the predominance of social grasses, which, in these warm valleys, well watered during the rainy season, generally consist of colossal species, mostly of the sugar-cane tribe. At this time of the year they are dry, but still well preserved, and afford as pretty as characteristic an aspect. The tall and stately bamboo (7 | 8 d), playing an important part in some of the valleys near the shores,—for instance, in the Bay of Umatá,—surely bears much resemblance to the large *Bambusa arundinacea*, so common about Manilla, and is perhaps identical with it; in that case making it difficult to decide whether it has not been introduced from there and become naturalised here. The same question suggests itself with regard to the other plants here represented; for instance, the papaw (*Carica Papaya*, Linn.) $\left(2\,\frac{d}{e};\ 2 \mid 3\ b\right)$ growing isolated about the outskirts of the woods. The turf in the extreme foreground of our picture is partly formed by the widely diffused *Convolvulus maritimus*, which here retreats some distance from the shores of the sea. In its neighbourhood we behold the cocoa-nut palm, the natural associate of man, so common on the shores of the island, and used by the inhabitants in various ways, especially for making toddy, or palm wine, which in a thickened state constitutes a well-flavoured and nutritious syrup, but, after fermentation, an intoxicating beverage. Behind this palm tower stately forest trees, amongst which may be distinguished a couple of wild bread-fruit trees (*Artocarpus incisa*), common in all the woods of the island. Amongst

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them grow several other fine trees already known to us from the Carolines, especially splendid and numerous specimens of the *Barringtonia speciosa*. To our surprise this fine tree was used as fuel, and its square fruits covered the ground as the mast of beeches does in Europe. *Morinda citrifolia*, already mentioned at Ualan, is here as common as in that island, and seen isolated on the outer margins of the forests (10 l). The finest and most conspicuous figure in this view is, without doubt, an areca palm, termed "*Bunga*" by the natives $\left(9\ \frac{k}{l}\right)$, and differing from that commonly cultivated about Manilla, not in habit but in the shape of the fruits, they being spherical, not oblong like acorns. The splendid plant is an ornament of most valleys of the interior, the heart of its leaves being esteemed as "cabbage," but very seldom eaten on account of the rarity of the plant. Amongst the plants of the foreground, on the right hand two species of *Pandanus* are conspicuous. The largest, *Pandanus latifolius* $\left(15\ \frac{k}{l}\right)$, does not strikingly differ from plants of the same kind in the coral islands; here it is not very rare, though less common than the already-mentioned narrow-leaved species. The smaller species $\left(13\ \frac{p}{q}\right)$ we have seen nowhere except here; it is always stemless, has a simple crown, and a pale bluish tinge.* The bushes behind this figure are those of a species of *Limonia*, with rather resinous but aromatic fruits, much sought after by the wild pigeons,—a thorn flourishing in abundance in all the woods of the island, and, on account of its delicate branches, less noticed by the eye than, on account of its prickles, felt by the skin. The bushes on the left chiefly consist of *Hibiscus populneus*, thickly overrun by the same creepers noticed in Ualan, amongst which a *Stizolobium* predominates. On the right rise several thickly leaved branches of *Hernandia ovigera*, to all appearance shoots of an old fallen trunk of a tree, which is amongst the largest forest trees of the island.

* Probably *Pandanus caricosus*, Rumph.—*Berthold Seemann.*

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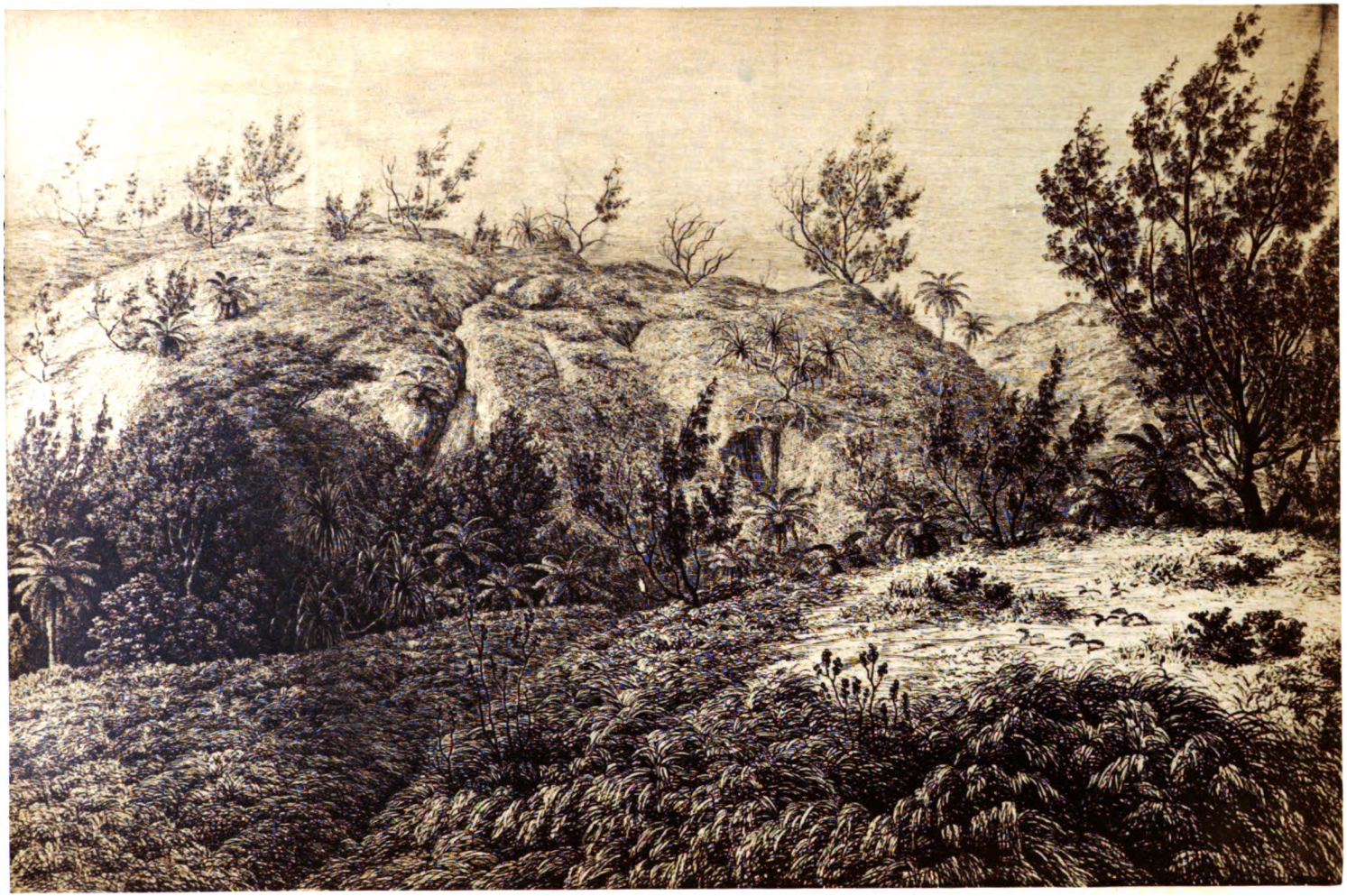

PLATE XIII.

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PLATE XIII.

GUAHAM.

UPPER SAVANA DISTRICT.

March.

The woody hills rising near the sea are followed, as we ascend, by rather extensive meadows, here and there crossed by little valleys full of trees and shrubs. Further in the interior these grassy plains gradually merge into steep hills, piled together, the herbage of which disappears soon after the commencement of the dry season, to lay bare the naked soil. The above-mentioned *Casuarina* is here principally at home, its isolated stems occupying the heights in almost regular distances. It would be difficult to find a country more strikingly defined by characteristic plants than the present is by the combination of this *Casuarina* with the narrow-leaved *Pandanus* and the *Cycas revoluta*. The first-named has a peculiar elegance of growth, rendering it evident that the plant has flourished on the open heights of the island, and under the constant influence of the trade wind. Its light, airy, fluttering habit presents an agreeable sight $\left(15\ \frac{1}{m}\right)$. The present view exhibits one of the places where the character of the just-mentioned grassy plains merges into the naked hills. The foreground is covered with tall *Cyperaceæ*, which, though dried up, still preserve their shape. Their dry leaves are often so sharp that an accidental contact with them may impart a serious wound. As the grass is the first to suffer from the aridity, the naked parts here and there bear a *Mertensia* (13 o), and especially a little shrubby myrtle (14 | 15 o) of elegant aspect, and growing even at the distant heights near the isolated *Casuarina* trees. The wood in the centre principally consists of a collection of trees also found in the lower forest region. Only the shrubby *Scævola* (2 | 3 f) and the *Casuarina* itself are found lower down in the immediate vicinity of the

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sea. A stately *Calophyllum* (6 e) here abounds. Nor is the already mentioned *Areca*, in this kind of woods, a scarce palm, agreeably contrasting with the taller trunks of the *Cycas*. A fine *Mimosa*, with umbrella-shaped crown, $\left(4\ \frac{d}{e}\right)$ is seen on the slopes of the naked hills; this tree is not abundant in the island, and resembles in habit the acacias bounding the deserts of Northern Africa.

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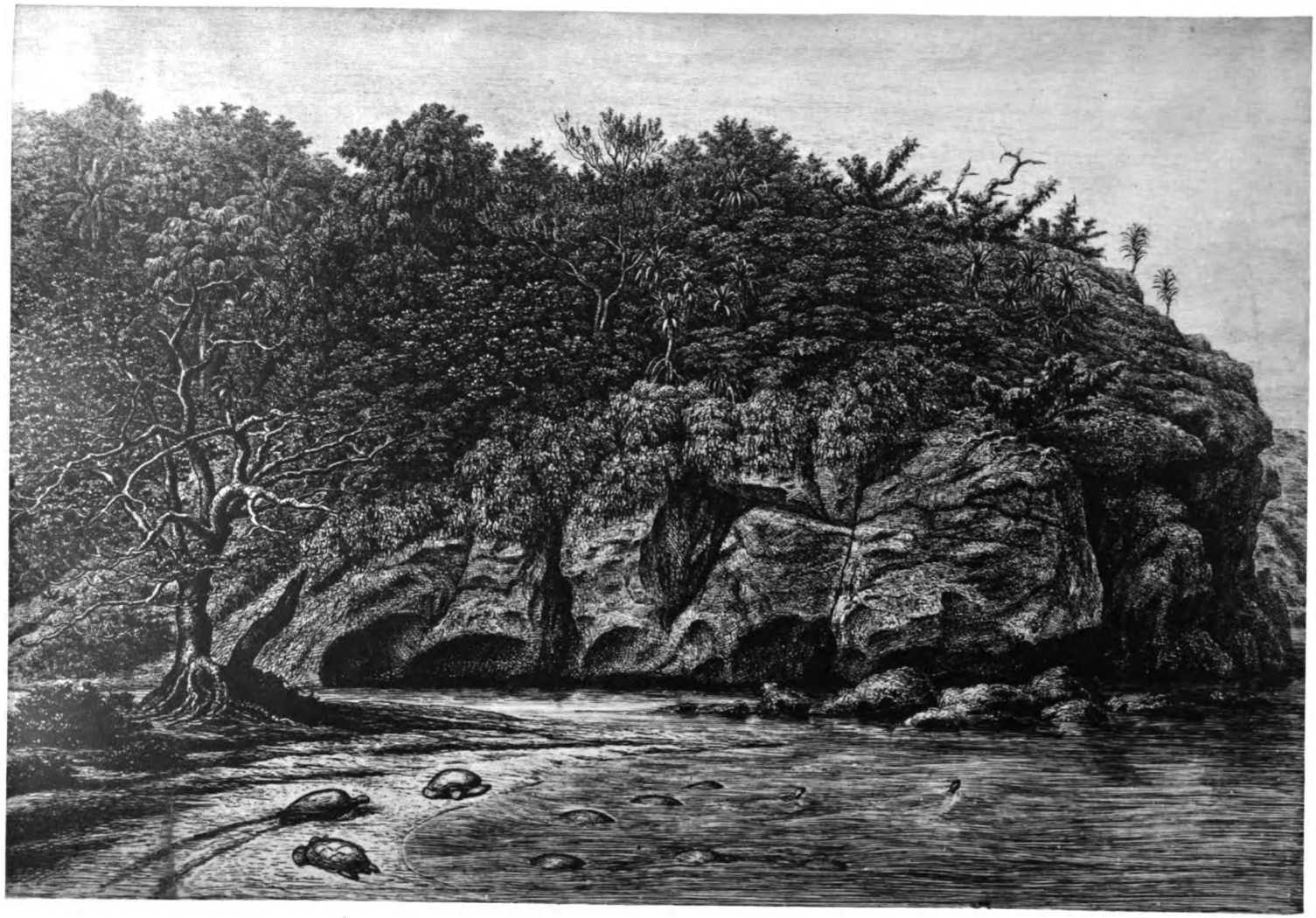

PLATE XIV.

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PLATE XIV.

PEEL ISLAND, BONINSIMA GROUP.

SEA-SHORE.

May.

In the year 1827 the Boninsima Islands presented the charming sight of an uninhabited woodland, favoured by a beautiful climate. Steep volcanic mountains, at the foot of which but little level land is found, are covered with a fine high forest of eminently tropical character. Only where the lava-like basalt, of which the shores chiefly consist, unprotected against violent gales, begins to be wooded, is a shrubby vegetation, such as is seen in the centre of our illustration. A carpet of light green *Cyperaceæ* covers the naked rocks; higher up is seen brushwood of eminently myrtle-like character, the climate of the island principally showing itself in the forms of the myrtle and the laurel. True, we have here a peculiar mingling of the physiognomic character of different climates; whilst the *Pandanus*, the fan-palm, the *Terminalia*, the *Scævola*, &c., recall to mind the tropical zone, we are reminded of the northern by many other plants, amongst which the present view exhibits only a conspicuous and abundant juniper. This species chiefly grows in the soil here represented; fig. 5 | 6 $\frac{b}{c}$ is a very tall specimen; on the bare rocks it assumes a more crippled growth, which curiously contrasts with that of the neighbouring screw-pines (*Pandanus*), of which there are on these rocks two species, the smaller bearing an orange-coloured fruit, the other a green one when in a state of maturity, whilst both exhibit scarcely any difference in the look of the leaves; the larger is the most common in the island, and generally has only one crown of foliage on its straight upright trunk. A highly characteristic plant occurs on the projecting points of these otherwise bare rocks (14 l). Dr. Mertens calls it in his notes an "arboreous *Campanulacea*," and could not determine it

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more accurately; it is confined to the immediate vicinity of the sea. The foreground of our illustration exhibits the loose deep sand of the shore, in which about this season numerous tortoises belonging to a large species of *Chelonia* bury their eggs. Different kinds of bushy herbs begin to appear where the sand merges into the more fertile soil of the island; one of them resembles our *Melissas*, the other have pretty pinnated or lobed leaves. Close by we see similar bushes, but of larger dimensions, of the *Scævola Kœnigii*, the acquaintance of which we already made in the Carolines. The largest tree in the foreground $\left(3\ \frac{d}{e}\right)$ affords a striking instance of the deviations in habit which one and the same species of plant (or animal) exhibits in widely separated and different climates of these islands. This tree is a *Terminalia*, and, according to Mertens' conviction, identical with what was believed to be *Terminalia Catappa* of Ualan and Guaham. In the first of these two islands, the tree has a slender, nearly always striking habit, whorls of horizontal branches diverging from the straight stems, like so many stories. In Guaham this habit becomes less regular, and here the stem is divided into several, and the whole assumes a habit not in the slightest degree reminding us of the former.* In Ualan the tree occurs isolated, in Guaham in small groups; here it covers whole districts of the plains immediately adjoining the sandy sea-shores. Its foliage seems to have appeared in the first days of May, and developes itself rapidly from day to day; for, notwithstanding the mild climate of this island, there were, on the whole, many trees which began to get green very late. Seen from a distance, the fine forest, which covers the whole island, with the exception of such plains near the shores, is characterised by beautiful palms, everywhere projecting. They belong to two very different species; the isolated cocoanut palm, seen close to the landing-place, has probably got there by some accident, and can scarcely be regarded as indigenous. But abundant throughout is a fine large fan-palm (*Corypha Japonica?*) (3 c), which forms a striking contrast with the slender-growing *Areca* $\left(2\ \frac{b}{c} \mid 4\ \frac{b}{c}\right)$ crowding the slopes of the hills.

* The author doubtless here confounds several distinct species. The habit of *Terminalia Catappa* is certainly very striking and regular, but that of the species so common on the beaches of these regions (I have not yet determined the species with any degree of certainty), though occasionally assuming a similar habit, is generally less regular and peculiar; nor do its leaves undergo such fine changes of colour as those of the well-known *Terminalia Catappa*. See my official "Report on the Vegetable Productions and Resources of the Vitian or Fijian Islands, addressed to His Grace the Duke of Newcastle."—*Berthold Seemann.*

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PLATE XV.

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PLATE XV.

BONINSIMA.

WOODED PLAINS OF THE SEA-SHORE.

May.

THE foreground of this view adjoins that of the last, exhibiting the plants which grow immediately above the sand of the sea-shore, those thick bushy herbs and the creeping *Scævola*. Close behind commences the forest, which, though covering without interruption the whole island, is very rich and diversified on the foot of the mountains, where there is some level land. A number of fine tall species of trees grow here intermingled in a tropical manner. It is self-evident that many of them could not find room in a plate of such limited size; even amongst those introduced there were several which, as might be expected, could not be determined at once. A characteristic peculiarity of this forest is the disproportion between the crowns and larger branches, and the considerable thickness of the stems of the trees. This feature is observed only on the plains near the sea-shore, but here it is so general that one is inclined to ascribe it to perhaps a regular periodical phenomenon of Nature,—an unusual high tide which occasionally floods these plains and rises above the tops of the trees. We met with two sailors who, having suffered shipwreck, and been left on this island, witnessed a year and a half ago one of these catastrophes, and were compelled to take refuge up the mountains. Perhaps this is an answer to the question which every one asks on seeing these beautiful islands, How is it that the Japanese have known them so long, and yet they have remained uninhabited? This would leave little hope of their becoming peopled, for all the land *above* these plains is mountainous and steep, probably little suited for cultivation. At present the islands offer to the numerous whalers frequenting these seas a good supply of wood and water. The forest, of which our plate gives a fair specimen, can everywhere be penetrated with ease, is strikingly beautiful, and

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presents a strange mixture of forms belonging to the tropical and the temperate zones. The most common tree, growing gregariously, is a species of *Calophyllum* $\left(15\ \frac{m}{n};\ 3 \mid 4\ e\right)$, apparently the same as that of the Caroline and Marianne groups. The bark of the stem is rough, and of a dark brown colour, that of the branches much more tender, and light yellow. The wood, of a dark reddish brown, takes a fine polish, and seems well adapted for carpentry and cabinet work. Near it grows the *Hernandia ovigera*, hardly less abundant (8 | 9 l), known by its smooth cream-coloured bark, and the numerous roundish excrescences of the stem; its thick foliage is of a fine fresh green. The above-mentioned *Terminalia* (12 i) grows here isolated and amongst other trees, and disappears farther inland. The same remark applies to a *Cerbera*, to all appearance the same as that in the Carolines and Mariannes (7 | 8 c), the foliage of which, in this spring time, just begins to come out. Highly characteristic of these littoral plains is a species of *Ficus* $\left(11\ \frac{l}{m}\right)$ with a very straight stem, somewhat resembling in habit the Italian poplar. This tree is generally overrun by different creepers, amongst them one, the dark leafless ropes of which are hanging down from the top. In its immediate vicinity grows a young specimen of a large-leaved *Laurus* (12 | 13 k). Amongst the forest trees of first magnitude, the determination of which is out of my power, but the features of which are carefully represented, are the following: —

Fig. 6 | 7 b.—Bark full of rents, but rather tender, of dark brown colour even in the youngest branches; leaves pinnated, light green, forming pretty boughs.

Fig. 9 | 10 $\frac{l}{m}$.—Bark resembling that of the foregoing, but lighter in colour, and, on the whole, rather rougher; leaves oblong, undivided, and darker than those of the last mentioned.

Fig. 5 $\frac{b}{c}$.—Stem tall, but always slender; bark smooth and tender, whitish yellow; leaves of the same shape as those of the last, of a fresh green.

Fig. 14 | 15 i.—Stem as that of the last; leaves pinnated, and light yellowish green. The leaflets are generally pointed, and it is, on the whole, more the form of the ash than that of the *Mimosa*, towards which the most of the trees of this island incline.

The underwood amongst these fine and numerous kinds of trees constitutes the peculiar character of the vegetation. Amongst the tropical forms the beautiful

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Corypha japonica (?) occupies the first place. Our illustration shows a young specimen of it (7 e) already bearing fruit, roundish nuts, or rather woody berries, which supply food to the two larger species of pigeons inhabiting this island. Close by (4 | 5 f) a seedling is growing, which has just put forth a few leaves. The above-mentioned screw-pine (*Pandanus*) with simple crown, is the second plant of this kind; it is here met with in considerable number, and the few specimens with two crowns are probably accidental varieties of the same species. A beautiful *Crinum*, the flowers of which are just about to fade (2 f), is remarkable on account of the great length and thickness of its rather decumbent trunk. We only found this solitary specimen, and are, therefore, not sure whether it may not have been introduced, like that cocoa-nut palm. Other plants here represent the temperate zone; the most striking among which is a species of *Sambucus*, bearing considerable resemblance to our *Sambucus Ebulus*, but it has thicker stems, and, on the whole, a more robust growth. The umbrella-shaped branches of flowers terminate the tops of the plant. It always grows gregariously, and forms the chief portion of the underwood (9, *o*). In company with it is found a species of *Rhus* $\left(7 \mid 8 \ \frac{f}{g}\right)$; a tall *Rumex* $\left(6 \ \frac{f}{g}\right)$ and an *Angelica* remind us still more forcibly of Northern Europe or Asia. Of the latter $\left(6 \ \frac{g}{h}\right)$ only the young leaves of this, and near it a couple of dead stems of the previous year, are visible.

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PLATE XVI.

BONINSIMA.

WOODY MOUNTAINS.

May.

As has already been mentioned, the steep hills of this island rise at a short distance from the sea, and the forest covering them assumes even more the character of the temperate zone than the plains near the shores. Of course this can apply only to the different deciduous trees of which it is composed. The underwood, in this elevation of from 200 to 500 feet, is principally formed by the two above-mentioned palms, the screw-pine, and a great variety of tree ferns; the latter more particularly rendering the difference between the shores and mountains evident. The scene represents the rocky bed of a rivulet, now dry, but in the rainy season probably very turbulent. The aërial roots of the screw-pine, between which the water has to force its way, appear of great size and strength; the trunks rise to a considerable height, and often bend in a picturesque manner (4 b). Not less surprising is the growth of the tree-ferns $\left(10 \mid 11 \frac{m}{n}; 6 \mid 7 \frac{e}{f}\right)$. The Areca palm occurs perhaps in no locality in such abundance as in these rivulets. The cabbage supplied by the heart of its crown is of good flavour and nourishing, but hard. A species of *Freycinetia* grows in these islands; here we have a young specimen rising from the soil, and about to climb on a neighbouring stem (4 | 5 f). In the foreground there is an old fully developed specimen of the fan-palm $\left(14 \mid 15 \frac{l}{m}\right)$, and just behind it (12 | 13 n) a young one. Behind it again $\left(10 \mid 11 \frac{l}{m}\right)$ rises a tree of peculiar shape, which we have not determined; judging from its growth it may be an *Aralia*, perhaps *Aralia japonica*. The laurel-like shrub at the foot of the two tall tree-ferns (10 | 11 o) may perhaps be the same *Laurus* which we consider as *Laurus Sassafras:* its leaves were used as tea by the two shipwrecked sailors whom we found here. Amongst the low brushwood in the foreground is *Olea fragrans*, abundant in this island.

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PLATE XVI.

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PLATE XVII.

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PLATE XVII.

KAMTSCHATKA.

MEADOW IN THE AWATSCHA RIVER DISTRICT.

July.

This peninsula, situated on the extreme end of the old continent, so interesting to the geologist, has little attraction for the botanist and zoologist, at least to those from Europe. Not that Nature is less productive, or that there is a want of organised beings, but, curiously enough, the repetition of the features of Central and Northern Europe is much more perfect than one would ever have expected from the great difference in longitude. This is more particularly the case with regard to the fauna; but the number of European plants is also considerable, and in some localities one is inclined to suppose that two thousand years ago Germany and the Baltic provinces may have borne a very similar look. There is no want of fine scenery, the eastern part of the country especially offers fine views of mountains. Volcanic cones, rivalling in height the Peak of Teneriffe, and surpassing all others in regularity of their conic shape, alternate with long sharp-pointed mountain chains, throughout the year covered with snow, whilst the other parts of the landscape are everywhere decorated with herbage and forest. The western coast districts are mostly swampy moors, but in the interior of the country the steep mountain chains define extensive plains of a doubtless fertile soil, partly covered with forest, partly with herbage, generally with both alternately, and through which the principal rivers, Kamtschatka, Awatscha, and Bolschaja Reká, wind their way. The sources of all three are close together in the table land and mountains of Ganal, whence they diverge in very opposite directions. One of these grassy plains, diversified by groves of birch trees, is represented in our present illustration. It is principally the presence of birches and willows which indicates its belonging to the Awatscha River district. The birch is not *Betula alba*, so common on the Kamtschatka River, but *Betula Ermanni* of

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Chamisso, which, in all other parts of the country, takes the place of that species as the principal forest tree. It has somewhat the habit of our oaks; curiously twisted stems with bark full of rents, and more grey than white in colour; leaves and flowers differing but slightly from those of *Betula alba* $\left(2\ \frac{c}{d}\right)$. Of willows only two species are seen; the first, here a mere shrub, is the common willow, which throughout the country ornaments the banks of rivers and brooks, and is probably identical with the one we are wont to see in Europe. The other, however, emphatically belongs to this district; at least it exhibits nowhere else such a tall slender habit and extensive range as here $\left(12 \mid 13\ \frac{l}{m}\right)$. On account of its habit one would be inclined to take it for a poplar; but it is a genuine willow, with narrow pointed leaves, on the upper side dark green, and of a silvery grey below: its robust straight stem has a delicate bark of a dark greyish-brown colour, and full of longitudinal rents; its wood is hard, reddish-white, and much used for fuel. This tree is here only known by the Russian name of "*Wetlofnik;*" it is again met with in the upper Kamtschatka districts, nearly as fine but more isolated, and on the western rivers of the peninsula it assumes a much poorer, almost crippled aspect, rendering it difficult to recognise again. These groves of willows sufficiently indicate running streams in the background of the picture, and the same is done still more forcibly by the alders growing there (15 | 16 m). This alder, so much attached to the water, may perhaps not essentially differ from the common European, the whorl-like arrangement of its branches and its dark foliage may be only local peculiarities. But near it we behold a plant which causes Kamtschatka, though only in the summer months, to differ from all other countries. This is the tall *Spiræa Kamtschatica* (Schalameynik), which, always growing gregariously, somewhat reminds us of the *Panax horridum* of the north-west coast of America, and curiously enough represents that form of *Araliaceæ* physiognomically (15 n). It is a wonderfully quick-growing herb, which in a few weeks attains ten feet in height, but disappears much quicker in the autumn, as a single night's frost is sufficient to prostrate it. In July the summits of its stems are decorated with large white corymbs of flowers, which afterwards assume a greyish tinge. A very tall *Heracleum* (*H. dulce?*), here called "*Slatkaja Trawa*" (*i. e.* sweet herb), flowers simultaneously and grows amongst the Schalameynik $\left(16\ \frac{m}{n}\right)$. The stem of this plant has been used in Kamtschatka, from time immemorial, for making a kind of sugar, of which little crystals form on the stem in drying. In Keller's time an inferior kind of brandy was with much

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trouble extracted from it, but this does not seem to be attempted now-a-days. The grass in the centre of our picture principally consists of a few species of *Festuca*, which also assume a surprising height. They are not yet fully developed, and one can guess from the branches of the shrubs how much higher the grass has still to grow. An *Angelica* of peculiar form, common throughout Kamtschatka (9 p), is seen here and there, and where local circumstances have kept back the luxuriant growth of grasses, which also is favourable to the development of other plants, for instance, two species of *Sanguisorba*, very common hereabouts. The generally tall shrubs rising isolated amidst such grassy plains are the following (8 e): — A species of *Cratægus*, common throughout Kamtschatka, and termed "*Choirem*," in the language of the country, "*Bojaruschnik*," in Russian *; the ripe fruit is almost black and considered to be injurious, the foliage is of a fine light green $\left(10 \mid 11 \frac{m}{n}\right)$. A species of willow, generally called "*Tschernoi Talnik*," or black willow; its habit and curiously twisted stems resemble very much those of the *Cratægus*, the leaves are small and comparatively broad, and their colour inclines towards blue $\left(5 \frac{d}{e}\right)$. Another species of willow, much like the foregoing in habit, but of vividly green foliage, and rather myrtle-like leaves. This isolated robust brushwood is peculiar to all the meadows of Kamtschatka surrounded by forests. The thicket of herbs observed on the left-hand side of the foreground contains, besides the already-mentioned large *Heracleum*, two exercising a marked influence on the physiognomy of the country, — *Senecio cannabifolius*, Cham. (3 f), and the *Epilobium angustifolium*, also known in Europe (7 g). The latter occurs perhaps nowhere in such masses as in Kamtschatka. When in full flower it tinges whole districts with a beautiful red, and to others the tall Senecio imparts a yellow colour. Both just begin to flower about this time; their proper season is August. In their company is encountered the tall *Cacalia hastata* $\left(4 \frac{e}{f}\right)$, which, however, grows less gregariously. Two beautiful *Liliaceæ* are here flowering; they belong to those plants the bulbs of which supply man with food, and here known collectively as "*Sarannah*." That termed "*Awunik*" (8 g) is perhaps the *Lilium japonicum* of Thunberg, at least closely allied, bearing large orange-coloured flowers on its tall scapes. The second, "*Ofsjanka*" $\left(10 \frac{p}{q}\right)$, having the form of the flowers of *Lilium Martagon*, is distinguished by its slender

* Perhaps *Pyrus rosæfolia*, Cham., which I found in Awatscha Bay, in August 1848, attaining a height of eight to ten feet.—*Berthold Seemann.*

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and flexible stems, whilst its flowers are of a fine bright orange colour, and its bulbs consist of oblong pointed scales, the apices of which are turned upwards. These bulbs are, when boiled, a tender dish, of rather agreeable flavour, but not quite so nutritious and esteemed as the so-called Black, or Round Sarannah (*Fritillaria Sarannah*), already alluded to at Plate II. This *Fritillaria*, with dark purple flowers, generally grows in Kamtschatka everywhere amongst low grass; the bulbs are roundish, about the size and shape of the grains of Indian corn, surrounding the root like a wreath, below which several rows of smaller bulbs of gradually decreasing dimensions are observed; the whole thus obtains a spherical shape. The taste of this Sarannah somewhat resembles that of potatoes and chestnuts; it is more mealy than the latter and of greater consistency than the former, a good article of diet which in Kamtschatka replaces bread and other preparations in which flour is the chief part; but it is a pity that it cannot be gathered without great trouble; every bulb has to be dug out separately. There is besides another species of Sarannah, bearing the Russian name of "*Wostronoschka*," the flowers of which are said to be small and green, and appearing in the spring. I did not see them, but I did see the bulbs that had been collected; they had nearly the shape of the above-mentioned "*Ofsjanka*," but were smaller. Under the name of "*Gussinaja Sarannah*" (Geeze Sarannah) is comprised, it would seem, a plant with edible roots growing in swamps: but I have not been able to find out which species. The best and most esteemed Sarannah is termed "*Kamtschiga;*" but this grows in the northern districts only, which I did not visit. On the right-hand side of our illustration the grass is confined by brushwood, principally consisting of two species of roses $\left(13 \mid 14 \frac{o}{p}\right)$, the flowers of which, now in full bloom, ornament the country, whilst their fruit in the autumn supplies food less to man than to most of the larger animals of the peninsula, especially bears, rabbits, and foxes. Of the various shrubby *Spiræas*, so common in the country, there is a slight indication amongst the rose bushes.

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PLATE XVIII.

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PLATE XVIII.

KAMTSCHATKA.

FOREST ON THE UPPER KAMTSCHATKA RIVER.

July.

We have here reached the fine extensive plains through which the Upper Kamtschatka winds its way. Although the ground is everywhere covered with forest, strong proofs of a former dense population are visible; especially of places like the one here represented, it may be assumed that at one time or other they were occupied by human habitations. This is chiefly indicated by the frequent occurrence and the strong development of shrubby *Spiræas*, of which principally the larger species (*Spiræa salicifolia?*) always prefers inhabited places and forms that kind of brushwood. This *Spiræa* is distinguished by its fine cylindrical branches of pale pink flowers; *Spiræa betulifolia* and *Spiræa chamædrifolia*, both having white flowers, are found in its company. Very seldom is wanting a shrubby *Lonicera*, the fruit of which occupied the first place amongst the various edible berries, of which Kamtschatka produces such quantities. High shrubs of the *Cratægus* and Black Willow, alluded to in describing the last plate, are here seen growing in their peculiar manner above the low brushwood. In front of them is a small plain of very dry clayey soil, amongst the scanty grass of which beautiful flowers here and there make their appearance. The most conspicuous of these is a dark blue Flag (Iris, 8 f), very abundant in the country, and bearing some resemblance to *Iris Germanica*, but being by its luxuriant habit highly ornamental. A low creeping *Aster*, pale violet with a yellow centre, is not wanting about this season on dry places of this kind. The banks of the river are overgrown partly by rather tall grasses, partly by willow bushes, amongst which luxuriate a number of fine herbs, such as a couple of large-flowering species of *Achillea* and the *Sonchus Sibiricus*, two yards high $\left(3 \mid 4 \frac{e}{f}\right)$. The latter generally begin to flower when the above-mentioned Flag is fading. The high shrub on the right-hand side of the fore-

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ground is a species of *Prunus* (*P. Padus?*) with cylindrical bunches of flowers; its purplish-black fruit, about the size of a pea, is termed "Scheromka" by the Russians, and very much esteemed. It has rather an astringent taste, and is generally eaten after the seeds have been pounded. Of the taller forest trees we have first the Kamtschatkan poplar (3 | 4 b), which bears a great resemblance to the European *Populus balsamifera*, but it is distinguished by its stately habit and its straight stems with a rough deeply furrowed bark. The tree has this habit chiefly about the River Awatscha and the Upper and Central Kamtschatka. The vicinity of the latter seems to be its real home; it there grows gregariously over whole districts, and as a prevailing forest tree. Near the sea I have only seen low and crippled specimens, and that on the eastern as well as on the western side of the peninsula.* The wood of these fine straight stems is yellowish-white and soft; it is used in the construction of Kamtschatkan vessels, or for building houses, because other straight beams may not be at hand, but it is considered to have very little durability. The forest in the background consists everywhere of *Betula alba*, widely diffused on the Upper and Central Kamtschatka River. It gives place so abruptly and decidedly to the above-named *Betula Ermanni*, that, for instance, on the road from Ganal to Puschtschina, the vicinity of the Kamtschatka, in that locality still a little river, may at once be discovered by the aspect of the forest suddenly formed by *Betula alba*, instead of *Betula Ermanni* as on the coast. Lower down, near Klutschefskaja Sopka, the latter reappears. It is distinguished by its straight and regularly cylindrical stem, which principally flourishes in the central Kamtschatka districts; where also those numerous vessels of birch bark are manufactured, so much used in the country, and for which only the bark of perfectly straight stems is selected, which have to be felled for this purpose generally in July or the beginning of August.†

* During my stay in Awatscha Bay I did not meet with any specimens of this poplar in a wild state. In the garden of the Governor of Petropaulowsky, near Behring's monument, there is an avenue of these trees, named *Populus balsamifera*, in Hooker and Arnott's Beechey's Botany. See also my description of Awatscha Bay, in Hooker's "Journal of Botany and Kew Miscellany," vol. i. p. 144; vol. ii. p. 151; and "Narrative of the Voyage of H. M. S. Herald," vol. ii. p. 6.—*Berthold Seemann.*

† One of these vessels I have placed in the Museum of the Royal Botanic Gardens at Kew. I was told their name was "*Tujes.*"—*Berthold Seemann.*

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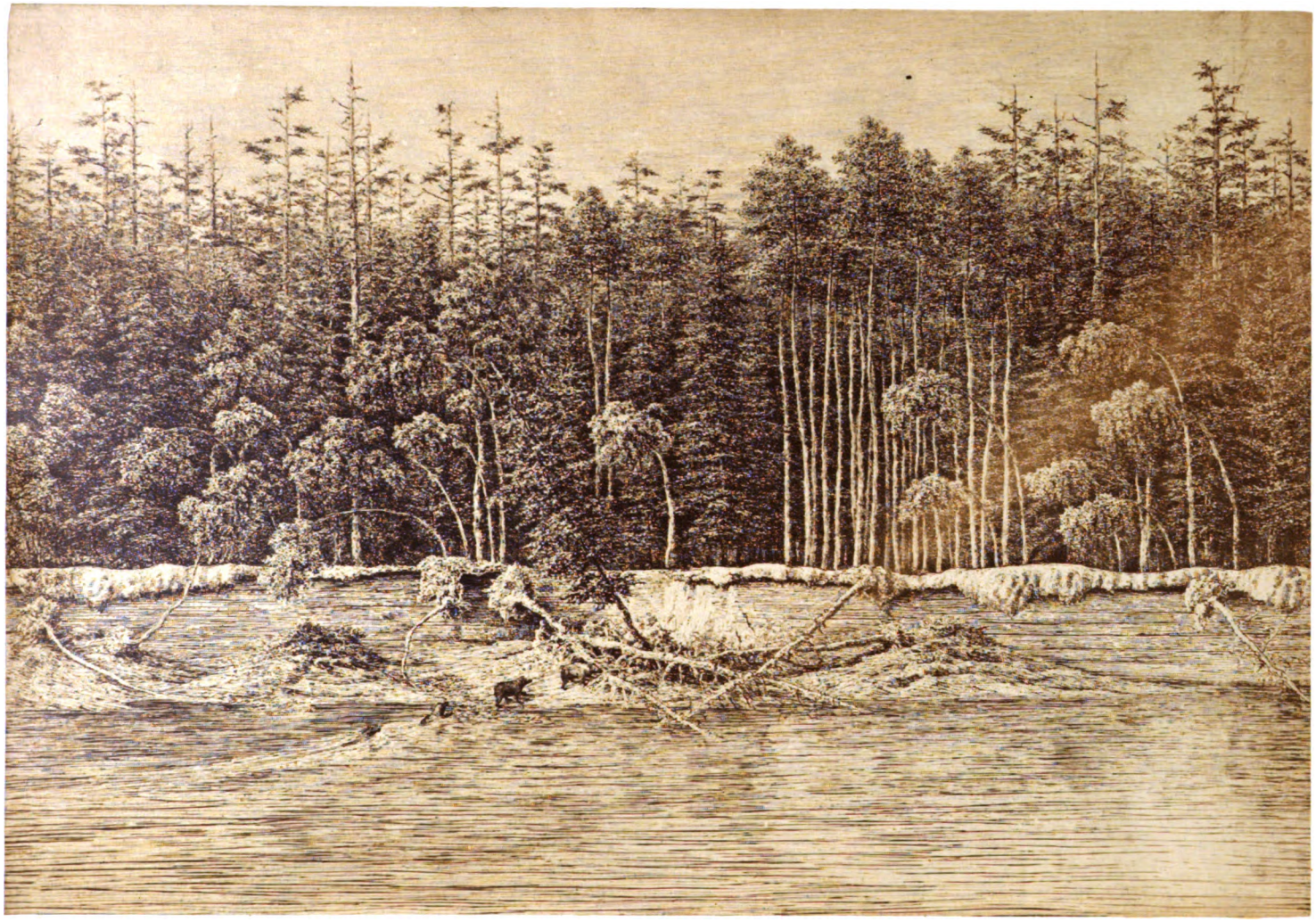

PLATE XIX.

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PLATE XIX.

KAMTSCHATKA.

PINE FORESTS ON THE CENTRAL KAMTSCHATKA RIVER.

August.

In the centre of the peninsula there is a district which it takes several days to cross, and which it would seem stretches from the western mountains to Cape Kronotzkoi; it is covered with forests of pines, of which, with the exception of a shrubby Cedar, there is no trace in other parts of the country. Two species of Spruce, one of which bears the Russian name of "*Liswen*" (Larch), strongly reminding us of the forests of Sitcha, and the *Pinus Canadensis* and *Pinus Mertensiana*, are prevalent there. The first, when fully grown, has a striking likeness to *Pinus Canadensis* (2 | 3 b; 14 | 15 k), whilst the younger specimens have more the aspect of our European larch. The second, a genuine Spruce ("*Yöll*" or *Yöllink*"), $\left(9 \frac{l}{m}\right)$, does not attain such a height as the first; its thick foliage is delicate and dark-green, and like the whole tree it has a peculiar balsamic smell. The fruit is rather smaller than that of *Pinus Abies*, but very like it. These two pines, growing intermingled, form the bulk of the forest, but in such a way that the taller species, that resembling *Pinus Canadensis*, is the most abundant; amongst them is found more or less plentifully *Betula alba* $\left(6 \frac{d}{e};\ 14\ m\right)$. The remarkable slenderness and comparatively great height of the stems here represented is principally produced by the same causes as their bent position, viz., the long continued pressure of heavy masses of snow which their crowns have to bear during the winter. We see further a very tall and slender, gregariously growing Aspen ("*Ossina*"), with a smooth whitish-grey bark. This tree, it would seem, occurs in great masses on the heights of the neighbouring mountains; it is but seldom found on the banks of the rivers $\left(10 \mid 11 \frac{k}{l}\right)$. The underwood of these forests, differing from those of the north-west coast of America by their prevailing dryness, consist of two or

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three species of Roses, the already mentioned *Lonicera*, and an allied species with scarlet inedible fruits; also a species of *Sorbus*, and perhaps a few shrubby willows. All these, intermingled, cover the level ground near the river with brushwood, about a yard high, not very thick and therefore easily penetrated. Below it grow a number of little plants bearing edible berries, such as *Vaccinium Myrtillus*, *V. uliginosum*, *V. Oxycoccus*, *V. Vitis idæa*, *Rubus arcticus*, *R. Chamæmorus*, *Empetrum nigrum*, &c., not to mention those the fruits of which are unfit for food. Among the edible ones those of *Rubus arcticus* ("Knäshniza") are the best flavoured and most esteemed; the next best is the oblong dark-blue fruit of the often mentioned *Lonicera*, which in fact equals that of superior cherries, and is very useful on account of its abundance. It is generally eaten with milk, and, mixed with Sarannah, made into different dishes. The whole of our illustration represents a "*jar*," or steep bank, very common in these districts of the Kamtschatka River. Curiously enough, nothing like it is seen on the Bolschaja, Beka, and Awatscha, but the Great Siberian rivers exhibit the same feature. Is it perhaps the northern direction of the Kamtschatka to which this correspondence is due? In that instance it would be a wise provision of nature that just those rivers destined to supply the northern forestless coasts with driftwood should collect those supplies by constantly changing their course. In the central districts of the Kamtschatka River, characterised by their conifers, the loose clay or sand of the bank, against which the current is forced, is very often so much undermined by the water that it falls down from time to time, by which such walls as here represented are formed, though they are generally much higher, the present being only a low "*jar*." The falling of the forests is such a frequent occurrence that, in travelling on these rivers, one hears nearly every night the noise caused by it. The amount of drift wood which this river carries is therefore considerable; even in the upper districts where there are numerous deep places, great masses are often piled up. What fine opportunity for the discovery of remnants of antediluvian animals must these continuous walls offer? Indeed, I heard of the discovery of very large bones made a short time ago in the Schapina district, and in such a "*jar*;" but I could learn no particulars.

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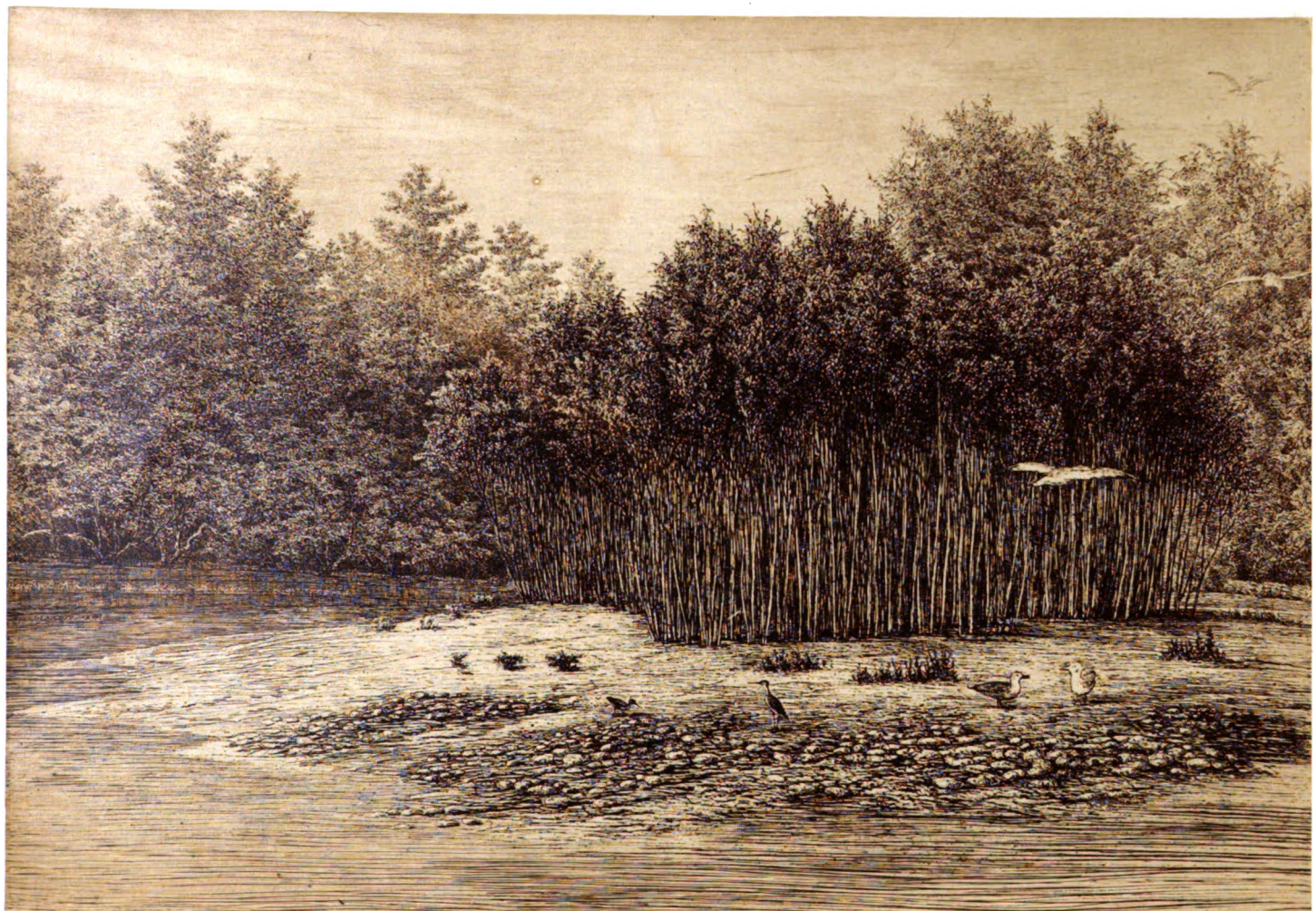

PLATE XX.

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PLATE XX.

KAMTSCHATKA.

DECIDUOUS FORESTS ON THE CENTRAL KAMTSCHATKA RIVER.

August.

OPPOSITE a "jar" there is generally a sandbank ("Pessok"); at every bend of the river the jar forms the concave, the pessok the convex bank. In the Central Kamtschatka districts these bends occur at such regular distances from each other, that the length of the road is determined by the number of sandbanks. These sandbanks generally consist of coarse gravel, and evidently increase at the same ratio as the opposite bank gives way to the force of the current. The first shrubs appearing on this new soil are nearly always willows. The curious habit which they exhibit in our illustration is common on the Upper and Central Kamtschatka River; lower down it is not observed. May not this peculiar habit be perhaps the consequence of long inundations? There are mostly upon these sandbanks a few yellow *Cruciferæ*, and perchance an *Artemisia* and a *Chenopodium*, growing gregariously in groups. On the left-hand side of the background is seen the mouth of a little tributary, confined by an alluvial bank of dark-brown mud. In such banks I always noticed the three equally thick strata indicated in our illustration, and in which the alluvial soil is deposited, though there was no difference in their component parts. On these perpendicular banks I often observed, and curiously enough, always on the second stratum, a small drooping *Equisetum* (3 f) growing gregariously. Another larger *Equisetum* covers farther up the surface of the mud, above which woods of the common willow, intermingled with a few alders, are growing luxuriantly. At a greater distance from the banks poplars replace the willows. Here we see (4 c) only a younger specimen of the species introduced in Plate XVIII., which on this side forms the forest, alternating with birch and different species of willows.

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PLATE XXI.

KAMTSCHATKA.

WOODY MOUNTAINS.

August.

THE character predominating on the whole eastern side of the country is here exhibited, beginning immediately above the steep walls forming the coast, and being repeated in its chief features in all the mountainous districts within the limits of the forests. The *Betula Ermanni* is the principal tree of these generally light forests. Those numerous thickets of willows and shrubby *Spiræas* characteristic of the valleys, are not observed on the summits of the moderate heights, on ground as that here represented, which may be perhaps 500 feet above the level of the neighbouring ocean. Even much higher the same character may be presupposed. On these heights one meets everywhere amongst birches isolated specimens of willows with tall stems (*Salix cuprea?*) (13 l), and possessing a slender habit and rather thin foliage. With the increasing altitude the thickets of underwood characteristic of these mountain forests assume greater dimensions, the birches alternating with them gradually become scarcer and of lesser height, until they disappear altogether, and make room for low thickets, to struggle against the Alpine flora, and be again displaced by it in the same manner as the birch forests have been displaced by them. As a rule these thickets are impenetrable to man, and remind us by their habit very much of those of the shrubby pines of the higher mountains of central Europe. In Kamtschatka they are, as our illustration shows, of a three-fold form. In the lowest districts those predominate which consist of *Pyrus sambucifolia*, Cham. $\left(3\ \frac{f}{g}\right)$, a plant known by the Russian name "*Rybina*" (Mountain Ash); indeed, its leaves so closely resemble those of *Sorbus aucuparia*, that at first sight one is inclined to consider it a shrubby variety of the same. But its vermilion-coloured fruits have not the bitter taste peculiar to

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PLATE XXI.

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the berries of our Mountain Ash; on the whole of rather a good flavour, they easily dry up when preserved, and are therefore, like the rose-apples, more sought after by bears, sables, &c., than men. At about 1000 feet height these thickets are no longer seen, but the more common are the other two, one consisting of an Alder, *Alnus incana*, Cham. $\left(11 \frac{m}{n}\right)$, the other, of the so-called "*Kedrownik*," by most botanists considered a variety of *Pinus Cembra* $\left(5 \mid 6 \frac{d}{e}\right)$. The Alder forms of all three the most extensive thickets; it commences even at a low elevation, alternating with those of the others, but at about 2000 to 3000 feet it alone remains, surrounded by an Alpine flora, bare rocks, and perpetual snow; and there is in all the higher mountains of the peninsula a region in which the soil is exclusively covered by it. The pine growing more isolated about the coast is here only a shrub, and the higher one ascends the more extensive become the thickets it constitutes. As long as its fruits are fresh the seeds can be eaten raw; they taste rather resinous, but aromatic, are a little larger than peas, of good flavour, and a thin but, in a dry state, hard dark-brown skin; they are eaten like almonds, and much esteemed in Kamtschatka. These fruits are the principal food of sables during the winter, of bears during the autumn. The soil of the light forest of birches represented in our illustration, between the above-mentioned thickets, is clad with grass of no great height and isolated shrubs of the two *Loniceras* and one of the Roses alluded to, characterised by its rather larger spiny fruits, which are of a better flavour than those of the others, provided they have not become soft by night frosts. Amongst the herbs in the foreground predominate about this season an *Aconitum* (11 o), a *Cimicifuga* (9 o), a *Cacalia* with very broad leaves (10 p), a tall *Artemisia*, and a very fine thistle without spines (12 o), which is said to occur also in Siberia, and is a favourite fodder of the horses of jakutic descent. There is also the *Epilobium angustifolium* $\left(14 \mid 15 \frac{o}{p}\right)$, which has attained its full height, and plays an important part in the domestic economy of the Kamtschadales, a part of its stem being preserved as an antiscorbutic dish during the winter. Except a species of *Clematis* (13 o), of which there is a specimen on the foot of the willow stem, there seems to be no creepers in Kamtschatka.

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PLATE XXII.

KAMTSCHATKA.

GRASSY PLAIN IN THE BOLSCHAJA REKÁ DISTRICT.

September.

THE western slopes of the peninsula, the principal river of which is the so-called "Bolschaja Reká" (*i. e.* the large river), present fewer picturesque scenes and botanical treasures than the other more mountainous side. Forests are fewer, quagmires and moors are more extensive, and everywhere about them predominate willow bushes. Most of the plants represented have been introduced in preceding plates; true, they begin to show the effects of night frosts, which have more or less caused their fading and discolourment; especially the tall *Umbellifers* have already been deprived of most of their leaves. These umbelliferous plants are more characteristic of these grassy plains than of any other part of the country. The tallest amongst them are the already-mentioned *Heracleum dulce* (?), and a species of *Angelica* of surprising dimensions $\left(3 \mid 4\ \frac{c}{d};\ 13\ k\right)$; it abounds in a few level valleys of the western slopes, principally in the district traversed by the Bannaja Reká, a tributary of the Bolschaja Reká; but is not met with again even in the neighbourhood of its real home. This stately herb is known throughout the country by the Russian name of "*Medweshie Koren*" (Bear's root); its hollow stems are dark reddish in the autumn, and those parts of the radical leaves still fresh are of a pale yellowish white green. Another plant (not figured in any preceding plate) is a tall, always gregariously growing nettle (*Urtica;* 15 m), which contributes an essentially characteristic feature to the country, but which does not occur anywhere in such masses as in these western districts. It is generally ten feet high, and bears otherwise much resemblance to our *Urtica urens*, without, however, stinging like that does.* Its long stems yield a superior fibre for nettle yarn, which in former times

* Rather *Urtica dioica*, Linn.—*Berthold Seemann.*

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was the only material the Kamtschadales had for fishing-nets; lately it has in some measure been displaced by plantations of hemp on the Kamtschatka river, which also attains an astonishing height. In the western plains, however, it abounds in such quantity as to have preserved its place in the domestic economy of the inhabitants. The forest at the background consists of *Betula Ermanni*, edged by low willows on the banks of a rivulet, beyond which is seen a bank-like elevation, the margin of which is overgrown by uninterrupted thickets of "*Kedrownik*." Regular hillocks of this kind, often having the appearance of artificial walls of earth, are common throughout the country, that is to say, curiously enough only on the western side of it; they begin already in the elevated district of Malka, and are seen as far as the sea; to the east of that water-shed I have observed nothing of the kind.

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PLATE XXIII.

LUZON, ONE OF THE PHILIPPINE ISLANDS.

VEGETATION OF THE PLAIN OF THE PASSIG RIVER.

January.

THIS plain, in which the populous city of Manilla is situated, everywhere bears proofs of an ancient population and cultivation. The river, which flows not very rapidly, has numerous tributaries, the banks of which are either swampy or sandy. The present view is intended to give a notion of such localities as are not under immediate cultivation. It will not appear strange, considering the great hurry in which we left this country, that I have little to say about the plants here seen. The most important among them is the bamboo (*Bambusa arundinacea*), which flourishes in great abundance, and the gigantic stems of which serve as fuel and even as timber (6 | 7 c). A low *Pandanus*, generally having several crowns, and growing on the sandy banks, will attract attention (12 n). Fig. 3 e is a yellow-flowering *Acacia*, often seen isolated on these banks; behind it are rising several fruit trees, amongst them, one must fancy, a tamarind, and a specimen of *Artocarpus incisa*, perhaps escaped from cultivation. The mango (*Mangifera Indica*) is a tree often planted, but which has also become wild, and now grows in great numbers in these woods, and even in fields. In the foreground a specimen of a beautiful *Erythrina* will arrest attention, which seems to be rather indigenous than to have escaped from cultivation. Its bark is soft, smooth, and of a light colour. It is now, during winter, without the slightest trace of leaves, but covered with large flowers of a pale-purple or blood-red colour. The bright colours with which the tree is decorated are therefore, about this season, one of the most striking objects in the country.

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PLATE XXIII.

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PLATE XXIV.

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PLATE XXIV.

LUZON.

UPPER SAVANA DISTRICT.

January.

The explanations I can offer of this plate are even less satisfactory than those of the last. From a convenient distance we scarcely ever lost sight of the mountains of the island of Luzon from its north point to Manilla, and everywhere we saw the character here represented, *i. e.* large grassy plains, upon generally not very steep heights, always alternating with less extended districts, covered with thick and tall forests, which only appear to be connected with each other at the foot of the mountains. The custom of burning the tall grasses during the dry season is practised all over the island, and in sailing along we had on several evenings an opportunity of admiring this peculiar spectacle. The view represented in our plate was taken in the mountains east of the Lagoon of Bahia, a lake drained by the river Passig, about 800 to 1000 feet above that lake. Although I have endeavoured to represent the aspect of the forest as faithfully as possible in its details, I am unable to name any of the prevailing species. On the whole, these forests are during this winter season remarkable for the number of leafless trees; the underwood, to which belong an endless variety of creepers, is very spiny, and renders the thickets scarcely penetrable. Amongst the creepers especially, there are many so abundantly clad with hooked spines that it is difficult to extricate oneself from them. The finest and most conspicuous form is the genus *Calamus* $\left(11 \mid 12\frac{n}{o}\right)$, which in a peculiar manner combines the character of palms with that of creepers. Long thin strings are cobweb-like crossing the forest, here and there exhibiting complete crowns of palm leaves, and their long nodding bunches of flowers are principally armed with claw-like thorns. Their number of species, and the masses in which

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they appear, seem to be very great in all the East Indian islands, but they prefer the lower forests, and are little seen in the higher mountain regions. In the district here represented scandent grasses begin to be prominent instead of them, certainly a strange form of creepers (9 n; 14 p), which exercise an influence on the physiognomy of the forest. The highest trees are overhung with rich curtains of this highly elegant plant, the leaf of which reminds us of *Bambusa arundinacea*, and contrasts favourably with the beautiful as well as diversified foliage of the forests. Another plant characteristic of these upper Savana bushes is a palm, probably belonging to the genus *Caryota* $\left(9\ \frac{c}{d}\right)$, which in its pinnated leaves resembles a tree-fern, from which, however, it differs in its robust mode of growth, and tall slender trunk.

THE END.

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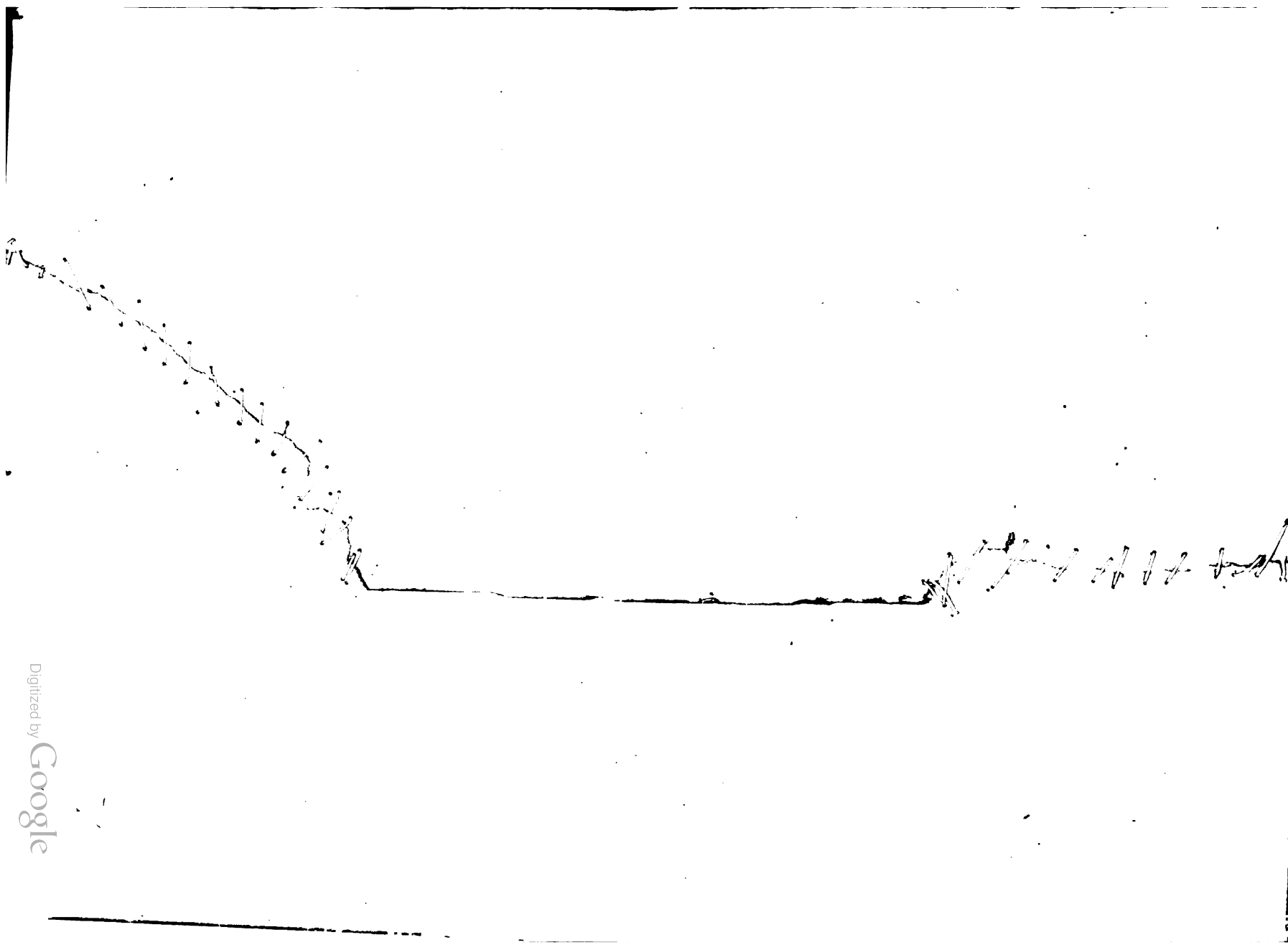

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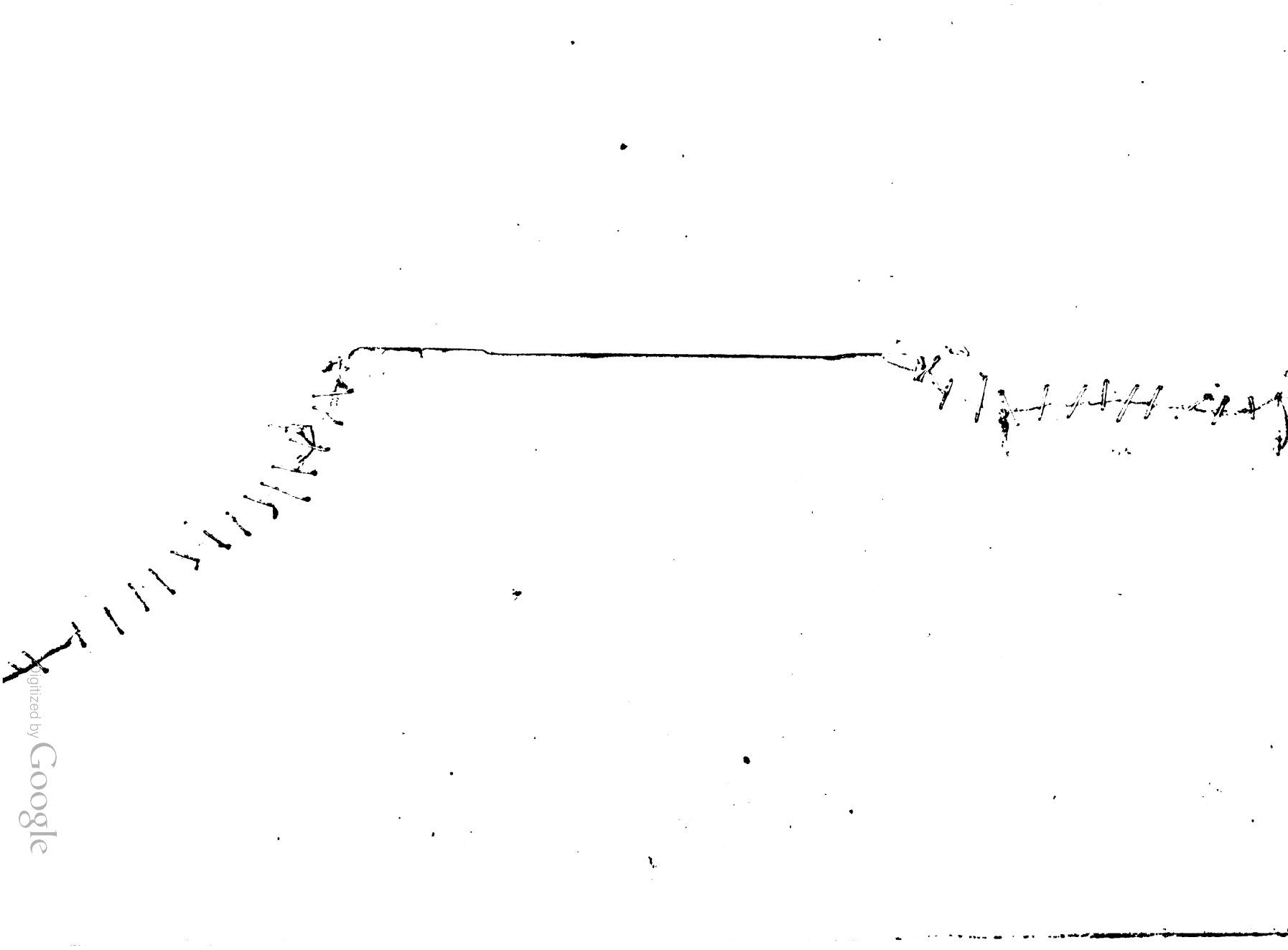
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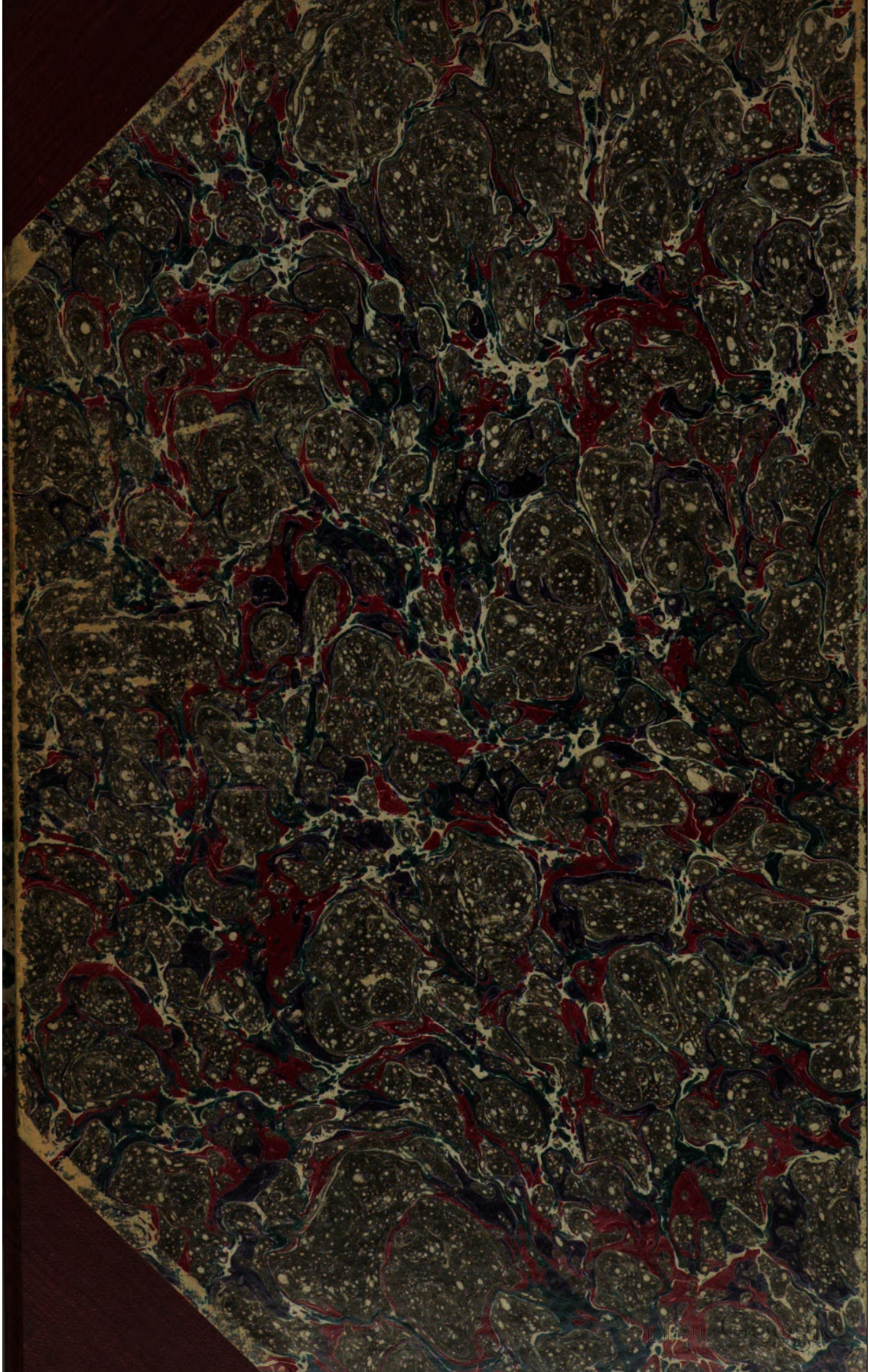
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